Food Manufacture

Incorporating Canning, Packing, and Preserving

Vol. VIII. November, 1933 No. 11

Fruit.

THE EMPIRE MARKETING BOARD is now dead, but a posthumous publication entitled *Fruit* has just appeared. From this booklet it appears that the world depression has had less effect upon the fruit growing industries, either in restricting international trade or in depressing prices, than upon any other producers of primary products. From it we learn that there are nearly 500,000,000 apple trees in the world, of which the United States has about a quarter. The United States and Spain are the great orange producers, but the Americans eat 90 per cent. of their own crop. Bananas represent over 80 per cent. of the export trade of Honduras and half that of Jamaica. The booklet also gives the chief production and trade statistics relating to lemons, grapes, wine, raisins, and currants. It is the last of the Empire Marketing Board's commodity series, which has now covered almost all the world's major agricultural products.

Storage of Honey.

In last month's issue we suggested that beekeepers would do well to store their honey for the winter months rather than to flood the market in summer and so get lower prices. It has been pointed out that it is very difficult to avoid fermentation in extracted honey which has reached or is just reaching the stage of granulation. This, of course, is more serious in a year of heavy crop.

In this connection it is interesting to note the work recently undertaken by the Department of Economic Entomology, at the University of Wisconsin.

It appears that the growth of the special yeasts responsible for fermentation in honey is more difficult as the degree of concentration of the sugar solution increases —*i.e.*, as the percentage of moisture in the honey falls. The yeasts in question flourish at temperatures in the neighbourhood of 60° F., but their growth is impossible, and no fermentation takes place below temperatures of about 40° F. on the one hand or above 75° F. on the other. It has been established that honey, even if completely processed and capped, is almost invariably liable to fermentation if kept continuously in a temperature of 60° F.

These results are very important in the case of the finer honeys commanding a special price by virtue of distinctive flavour and aroma, as these properties are adversely affected by the partial sterilisation often practised to prevent fermentation. Controlled temperature conditions of storage appear to be quite sufficient to keep the honey fresh.

Cake Flour.

The testing of cake flour is a matter that has received too little attention in the past. Cereal chemists and research associations have naturally devoted most of their energies to the investigation of the principles underlying bread making, and problems of dough have occupied most of their time. Cake making is, however, an important part of bakery practice and any information relative to the testing of cake flours is welcome.

G. L. Alexander, chemist to the Commercial Milling Co., Detroit, at the recent convention at Chicago, stated that fine granulation is important in cake flours for light cakes because of the manner in which the flour is mixed into the cake batter. In a first-class cake flour, approximately 95 per cent. should be fine enough to pass through a No. 11 XX silk and 70 per cent. through a No. 16 XX. He said that the usual routine tests for moisture, ash, protein content, water absorption, and colour should be applied to cake flours. The protein content should be low and the gluten quality soft and elastic. Of course the most informative test for cake flours is the actual baking test. This should be carried out on a rigid technique and no factor varied. Most

bakers will always try to get the best out of any flour, but in the laboratory this temptation must be overcome, and each flour examined by exactly the same methods.

Biscuit Flours.

According to Bohn of the Technical Institute of the Independent Biscuit Manufacturers Co., Chicago, biscuit flours may be divided into three types, based on strength, in descending order: (1) sponge flours, (2) dough and strong cooking flours, (3) very weak flours. The determination of ash and protein is not sufficient to classify flours into these three groups. Sometimes flours with the same ash and protein appear in each group. A modification of the Werner baking test (lower absorption and shorter fermentation) has been found suitable for determining the relative strength of flours and classifying them into the various types. Soft wheat flours, which give loaves with a good oven spring and a neutral or small plus reaction with bromate, make good sponge flours. The very weak flours, excellent for vanilla wafers, shortbreads, and hard sweets give a loaf with no oven spring and with a coarse grain. Often the dough perforates during proofing. This is the third group, and in the case of the second group there is less oven spring than in the first and usually a torn break. It is rather a unique idea to apply a breadmaking test to evaluate biscuit flours, but it is quite sound, and there is no reason why it should not give really valuable information.

Stability of Emulsions.

One of the major problems in cake making is the breaking down of emulsions known to the baker as curdling. When butter, sugar, and egg are agitated, a water-in-oil emulsion and air-in-oil foam are formed. The water is in droplets, the air is in bubbles, and the fat is the continuous phase. The stability of the emulsion has to do with its ability to resist breaking or the coalescence of the water droplets and the separation of the internal phase into layers.

In order to study this problem Emily Grewe of the U.S. Bureau of Dairy Industry has developed two methods. The first consists of allowing the emulsion to stand in a container and the aqueous phase to sink to the bottom as it separates from the emulsion. The second is to cause the subsidence of the suspended droplets and their coalescences under centrifugal force. In both methods the amount of the aqueous phase which separates from the oil is the measure of the stability of the emulsion. In addition to indicating the stability of the emulsion, the centrifuging test also gives information as to the stability of the foam.

Rancidity.

Further information on this important subject has been furnished by Triebold, Webb and Rudy of Pennsylvania University. They report that the susceptibility of fats to oxidative rancidity is dependent on three main factors: (1) the structure of the fatty acid glycerides comprising the fat, (2) the presence, kind, and amount of oxygenic catalysts, and (3) the presence or absence of anti-oxygenic catalysts. They produced data to support the contention that the keeping quality of a shortening, as determined by storage tests or controlled oxidation studies, was not a good criterion by which to judge that shortening with respect to its ability to produce a good keeping cracker. If shortenings are baked into crackers they can be evaluated more accurately with respect to the keeping quality of the crackers by the length of induction period of oxygen absorption of the crackers.

Research Grants.

It seems likely that several important aspects of research into foodstuffs will suffer from the reduction of grants. The five-year sanctions in the case of the Bristol and East Malling schemes expired in July and September, 1932, respectively. In both instances the grant was renewed by the Empire Marketing Board, but owing to the financial position, the scale of aid was considerably reduced, and, owing to the uncertainty of the Board's future, sanctions could only be obtained for interim grants taking the two schemes up to March, 1933, and then to September, 1933.

Sardine Canning.

In view of the interest which has been aroused in Dr. Beard's suggested method of sardine canning, outlined in last month's issue, it should be pointed out that this excellent piece of work on the part of the Bureau of Fisheries, of which Dr. Beard is Chief Technologist, appears to have borne fruit. So far as one can judge, the practice at present is carried out on the following lines.

Preparing and Cooking.

The fish on being discharged from the boats pass through rotary screens in which the scales are removed with the help of water sprays. Then they are decapitated and deviscerated.

The practice of oil-frying is declining. Instead, the cleaned fish, after a light brining which washes them and which also serves to toughen the skin, are placed in the cans by hand. The next step is to pass the cans, by means of a mechanical conveyor, through a "precook" which may take the form of a "broil," a "steam-grilling," a "bake," a "kitchen process," or some type of heat application. Various methods of steam

cooking or baking in ovens are employed for the purpose of removing oil and moisture from the fish. It is stated that the equipment for carrying the cans through these continuous cookers is extremely ingenious.

The pre-cooked cans are then inverted on screen carriers to drain away the water and oil.

Saucing and Closing.

The open cans next pass through saucing machines, after which the lid is applied to the can and seamed into position by a vacuum closing machine. In some cases the exhaust box is still employed. This, however, is usually obviated by the pre-cook.

Experiments have been made in packing sardines with a lemon-flavoured agar aspic which jells on cooling.

Concentrated Juice.

A number of interesting points are dealt with in the Report of the Government Chemist just issued. Thus, attention is drawn to the fact that the Merchant Shipping Act provides that every foreign-going ship shall carry a supply of lime or lemon juice, and that 1 oz. per day shall be served out to every member of the crew after the ship has been at sea for ten days. The chemical examination of the raw juice which it is proposed to ship, and of the juice after fortifying with spirit, is carried out in the Government Laboratory.

One is reminded, however, that an Order in Council has been issued (the Merchant Shipping (Anti-scorbutics) Order in Council, 1927) making provision for the use, if desired, of concentrated orange juice. The Order specifies the juice, and, *inter alia*, it is required that it shall be so prepared and stored that there is no material loss of potency in respect of vitamin value.

Onion Powder.

At the Massachusetts State College, C. R. Fellers has been looking into the question of preparing a powder from cull onions. He advises blanching them in boiling water for two to four minutes and then draining and cooling. After removing both ends by a sharp knife, the onions are stored in 3 per cent. brine preparatory to being cut up into $\frac{1}{8}$- to $\frac{1}{4}$-in. slices. These are spread in shallow layers on trays or screens and dried at 125° to 130° F. for three to four hours, subsequently rising to 140° F., the total time occupied being ten to twenty-four hours, depending on humidity conditions. The slices should be turned several times while drying; also, it is advisable to use an air-circulating fan.

On emerging from the dryer, the onion slices should be brittle and white or grey—not brown. Their moisture content is about 5 to 6 per cent., and the yield amounts to about 9 per cent. of the weight of the onions.

It is stated that the blanch of one minute duration after spreading the slices on trays is beneficial and hastens drying. Colour may be improved by bleaching with sulphur fumes in a kiln type of dryer.

Onion powder keeps fresh several years when packed in sealed containers.

Onion Salts.

One of the uses of onion powder is in the preparation of "onion salts," which contain, say, 10 to 20 per cent. of the powder, the other ingredients being mainly salt and starch. It is noted that, although they constitute an article of commerce in U.S.A., they have never enjoyed the popularity of celery salts.

Walnuts.

After examining various methods of bleaching walnuts, Mr. J. B. Hamond concludes that the employment of a solution prepared from chloride of lime and washing soda is the only one to be recommended. This treatment not only improves the appearance of the nuts, but makes the shells more resistant to attacks by moulds. It is obviously important that only nuts which are well sealed after the preliminary washing in water and subsequent drying (done rapidly at room temperature in a current of air) should be bleached, as a drop of bleaching solution inside the kernel will make it unfit to eat.

Preservatives.

One of our readers would like to have an expression of views on the following point. He says that he has noticed several enquiries concerning the keeping of brawn jelly, potted chicken, etc., and that the paragraph on the new preservative, Nipagin, has aroused interest.

Then he goes on to say that he is a manufacturer of cooked meats and that he has had endless trouble and loss since the use of preservatives was forbidden. "I should be glad to know," he asks, "if any of your readers have had a similar experience. In my opinion, borax is the perfect preservative, and its use is absolutely harmless. Several years have passed since its use was stopped, and the diseases which it was supposed to aggravate are not one whit better than they were before, showing that these diseases are not caused or even influenced by the use of borax. Surely some combined action by meat and milk traders might now result in the removal of this absurd ban!"

Such an expression of opinions from others would be extremely valuable.

Spaghetti Canning.

In a description of the canning of spaghetti in a recent American contemporary, some interesting remarks are

made on the blanching of the raw material with the object of softening it. Really, it is a pre-cooking or par-boiling operation occupying about twenty minutes. The raw spaghetti is placed loosely in boiling water (about 1 lb. to 1 gal.) contained in a steam-pan, to which about 1 lb. of salt to 20 gal. of water has been added. After blanching to the required degree—largely a matter of experience—the spaghetti is removed from the pan and immediately cooled in cold water, preparatory to being filled by hand into cans. Needless to say, the manner in which this blanching process is carried out has an important influence on the quality of the finished product.

Moulds on Bread.

Skovbolt and Bailey, of the Minnesota Experiment Station, are examining the influence of humidity and carbon dioxide upon the development of moulds on bread. They note that losses due to mould damage were not serious before the advent of bread wrappers.

From their investigations the authors draw the following conclusions:

Relative humidities of about 90 per cent. or more in the enveloping air are required to permit appreciable mould developing on bread crust within the usual interval of time between production and consumption.

Bread crumb is more hygroscopic than bread crust. The introduction of milk solids into bread slightly increases the hygroscopicity of both crust and crumb.

Carbon dioxide concentrations of 17 per cent. will retard, and if as high as 50 per cent. will prevent, mould growth on bread, but only while maintained in such atmospheres. Subsequent removal of bread so treated into a normal atmosphere results in as abundant and luxurious mould growth as though the treatment had not been applied.

Fruit Jelly Juices.

Professor Cruess and his co-workers at the Californian Fruit Products Laboratory have been active in advocating the packing for household use of pectinous fruit juices in bottled form. They have frequently called attention to the possibilities offered by such products. These juices relieve the housewife of the "mussy" job of cooking and straining fruits through the jelly bag and spread the jelly making season over the entire year. She can make loganberry jelly at Christmas or Easter, if she wishes to do so.

Starch and the B.P.

It would be interesting to know just what was at the back of the mind of the Pharmacopœia Commission when they decided to make maize starch the only official starch in the 1932 edition of the British Pharmacopœia. In the 1914 B.P. maize, rice, and potato starch were all official. The rather humorous or tragic—depending on one's viewpoint—aspect of this change of policy is that whereas maize starch is manufactured almost entirely in the United States, practically all of the starch made in England is rice starch! In other words, it would tend to give the impression, at first sight, that the new B.P. actually penalises British manufacturers of rice starch and extends a helping hand to American firms. Perhaps some of our readers may be able to supply the clue to the mystery!

Fats for Shortening.

The relation between the properties of a fat and its qualities for shortening pastry is discussed by Miss J. D. Fisher (*Ind. Eng. Chem.*, 1933, p. 1171), and as the result of experimental work described she finds that there is some possible connection between congealing point and shortening qualities. Even now, however, shortening is best determined by a direct test.

A series of commonly used fats were employed for making standard pastry mixes, and the piecrust wafers prepared were baked under uniform conditions. After twenty minutes' cooling they were tested for shortening by the Shortometer instrument (see *J. Home Econ.*, 1926, p. 417). "Shortness," says Miss Fisher, "is the quality of cookies, crackers, and piecrust which makes them tender and easy to break or crush. A mixture of flour, water, and salt bakes to a hard mass, owing to the adherence and continuity of the gluten in the flour. When a fat is added, being immiscible with the other constituents, it spreads and separates the gluten particles."

As the machine measures the breaking strength of the pastry in grammes, a refined lard was taken as an arbitrary standard, and other fats rated on the basis of refined lard = 100. The following table is taken from the paper, and shows the congealing-points and relative shortening property of the various fats tested out:

	Congealing-point, ° C.	*Relative Shortening Value.*
Lard. Refined steam ...	26·5	102
	26·5	101
	26·2	100
	27·2	100
Lard. Open kettle leaf ...	30·5	91
	30·0	90
Vegetable lard compound	34·0	83
Hydrogenated lard ...	33·4	74
Hydrogenated cotton seed oil	33·8	73
Animal stearin-veg. oil compound	33·8	73
Hydrogenated cotton seed oil	32·9	70
	32·9	69

PEA CANNERY WASTE

Mr. Potter suggests possible ways of tackling the problem of the profitable utilisation of the waste from pea canneries. They are suggestions based on study and experience, and if followed up are likely to yield results of great practical importance.

THE PROBLEM of the economic disposal of the pods or thrashed vines from canneries is one which involves considerable expense and often worry. Whether the peas arrive at the factory on the vine or in pods, the fact remains that the proportion which is actually canned is small compared with the residues. In the case of factories which have viner installations, probably less than one-tenth of the weight delivered actually enters the can, while factories equipped with podding machines probably use less than one-third of the delivered weight. These, then, are the facts, and unless the canner is able to dispose of his waste quickly it may very soon become a menace, for heating soon sets in, and offensive odours and swarms of flies become evident. Such fermenting vegetable waste is, moreover, a potential source of danger to the pack.

The Grower.

There are several very commonly practised methods of dealing with the waste material, but they all appear to be unsatisfactory either from the point of view of the canner or the grower. Probably the method most frequently met with is for the canner to insert a clause in his growers' contracts to the effect that they will take back a quantity of waste proportionate to the amount delivered. From the growers' point of view this should be a very acceptable arrangement, for the value of the pea straw as a source of nitrogen on the land is unquestionable. In spite of this, however, there are many practical difficulties for the grower. In the first place, it will be obvious that a grower cannot keep his horse or lorry waiting while his own particular delivery of peas is vined, so that he has to accept a proportionate load of the straw available. This straw may be from peas grown on clean land without much "rubbish" or weeds, but, on the other hand, the straw may be badly laden with all sorts of weeds. A keen farmer who is anxious to produce clean crops will not want to accept such material, and he is justified in taking this view, since whether it is used for feeding or for ploughing into the land it will probably introduce the seeds of many different kinds of weeds. Then there is the question of transport; it often happens that an outside contractor is employed by the grower to deliver the peas, and on account of the fact that he has to take a return load of pea straw he may lose an opportunity of a return load elsewhere at a higher rate. The grower who employs an outside haulage contractor may be put to increased expense for cartage charges. Con-

trary to expectation, many growers look upon the pea straw as worth nothing, and they will avoid taking it if possible. In this connection it is interesting to note that many landlords in some parts of the country actually compel their tenants by agreement to retain all the straw on the farm.

The Canner.

Considering the canner next, there are certain points concerning the method which indicate that there is much left to be desired even if he does overcome the initial difficulty of persuading the grower to take back his straw. It is impossible to load a lorry to carry its full quota of straw, since, owing to the nature of the residue emerging from the viners, it cannot be stacked so well. This means that at the end of the day the canner has a considerable tonnage of waste left. What is he to do with this? Practically the only solution is to cart it away to a "dump"; but it is not very satisfactory to pay for the cartage of waste material to such a place, which may be a considerable distance from the cannery. In addition, it is such objectionable material when it starts to ferment that quite often a certain amount of difficulty is experienced in finding a suitable place to put it.

It is somewhat remarkable that such trouble should be found in dealing with this vegetable waste material from canneries, for its chemical composition certainly suggests that it could be put to some profitable use by canners. Probably the bulk of the material in this country is disposed of as mentioned above, but there are other methods which have been tried out commercially which endeavour to utilise it instead of disposing of it as waste. Such methods include the following:

Drying and Grinding.

This method is more applicable to the waste from canneries equipped with podding machines, where the peas arrive in the pod in bags. Since the empty pods contain upwards of 80 per cent. of water, drying reduces the amount to be disposed of by four-fifths, and thus not only eases the problem considerably, but also transforms the waste into a form which can be held in store and sold as desired. Continuous automatic plants which dry the material straight from the podders may be obtained, and the grinding into a powder is often effected by the same plant. The dried vegetable emerges from the plant as a vegetable meal of high feeding value.

Probably the chief drawback to this method at the present time is the low price of the more common feeding materials, and owing to the low state of the market for such products, it is questionable whether there would be much profit in the drying of the waste in this way.

Preparation of a Fertilizer Material.

Owing to its high nitrogen content and the presence of combined celluloses, vegetable waste offers excellent possibilities as a starting-point for the production of a manure. When the material is allowed to lie in heaps for a day or so, fermentation soon begins and the temperature rapidly rises. In such an uncontrolled fermentation the valuable nitrogen and carbon compounds are lost in the form of ammonia gas, carbon dioxide, and other products. But it is quite possible to control the fermentation so that very little of these compounds is lost. The control of the fermentation depends upon the encouragement of the beneficial bacteria by regulating the air supply, temperature, and moisture content, and by the addition of suitable chemicals. Many processes for the treatment of green vegetable matter have been patented. In this country we have the Adco process, which, in the first place, was the outcome of extensive researches at the Rothamsted Experimental Station. There are many processes which involve the addition of mineral substances, such as calcium carbonate or lime, to neutralise the acid formed, and ammonium sulphate to stimulate the growth of aerobic micro-organisms which are beneficial. Phosphates and potassium salts in varying proportions also have a stimulating effect on the fermentation.

The result of careful treatment and control of the temperature, moisture, and air supply is a manure which resembles farmyard manure in properties and has a correspondingly high manurial value. Again, the disadvantage of developing such a method lies in the low price of manures at the present time.

Ensilage Fermentation.

The valuable feeding quality of the pea waste may be preserved by treatment in a silo, as in the case of other fodder. Attention has already been called to the uncontrolled fermentation of the material and its ultimate results, and this is but another instance of the way in which controlled conditions produce a valuable product.

It is probable that the changes which occur when vegetable matter is treated in a silo are due to the combined action of many types of bacteria and to the enzymes, or natural catalysts, of the plant material. The necessary strains of bacteria are present on the surface of the material in great numbers. When the pea waste is first placed in the silo it should only be loosely packed, so as to permit a moderate air supply. When the temperature rises to 35° to 40° C., due to the activity of aerobic acid-forming bacteria, a further quantity of the vegetable waste may be added. As the temperature again rises and the mass packs together, there will probably be sufficient room for several additional layers. When the silo is full, pressure is applied so as to limit the air supply and remove the acid juice. The activity of the aerobic organisms is thereby impaired, with a consequent reduction in temperature. Storage of the waste in this form may be effected for considerable periods.

Other Possibilities.

The foregoing has dealt with the methods at present in use for dealing with vegetable waste from canneries, but the purpose of this article was also to suggest new fields for exploitation. The nature of the material under consideration suggests a biological solution to the problem,

and although the following suggestions are in the main theoretical, they may serve as a starting-point for research by some of the larger canners.

The composition of the waste material will be found to vary considerably, but an average analysis shows about 2·75 per cent. of protein and 7·25 per cent. of carbohydrate. The amount of water is high and averages about 84 per cent. By a series of fermentation reactions it should be possible to utilise both the protein and the carbohydrate. Fermentation and micro-organisms are usually regarded in the canning industry as being associated with spoilage in some form or other, but it is quite possible for very similar organisms to those which produce this spoilage to be harnessed to perform useful work. Two such suggested processes are outlined below.

Acetic Acid Production.

It is well known that there are bacteria which thrive best at temperatures as high as 40° or even 50° C. These organisms are known as thermophyles, and are either inactive or only active to a lesser degree at normal temperatures. Some of these bacteria grow on nutritive organic media and produce acid and gas, while others may produce acid and no gas. The flat sour bacteria, which are sometimes responsible for the souring of canned peas and certain other vegetables, belong to the latter class, organic acids being produced from the carbohydrate. If we take waste material from the viners and pass it through a disintegrator and add about an equal quantity of water, we have an ideal mash for culturing bacteria of this type, since, in addition to carbohydrate, there are ample supplies of protein and mineral salts to serve as food for the organisms. The temperature should first be raised to 100° C. so as to give practically a sterile mash, and subsequently cooled to 60° C. and inoculated with a mixture of cellulose decomposing organisms and acid-forming bacteria, such as are universally present in manure. Fermentation soon sets in, the cellulose portion dissolving to form soluble carbohydrates, which are then converted into acids (mostly acetic acid). If the fermentation is allowed to take its normal course, the temperature being maintained at 60° C., it will probably be found that the reaction slows down when a *p*H is reached which corresponds with an acidity of 0·1 to 0·2 per cent. of acetic acid, but if some insoluble carbonate, such as calcium carbonate, be added, the acid is neutralised as soon as it is formed, and greatly increased yields of acid (in the form of acetate) may be obtained. A very rough practical test of the method has given as much as 5 per cent. of acid, calculated as acetic. When the acid has reached this level we have left, apart from the acid, a small amount of unchanged cellulose and most of the protein, which latter may be partially hydrolysed. If the equivalent amount of sulphuric acid be now added to liberate the acetic acid the latter may be distilled off and concentrated.

A Vegetable Paste.

It may be desirable and possible to proceed a stage further with the process, as follows: After the addition of the sulphuric acid, transfer the mash to a suitable plant where it can be treated under a steam pressure of 5 to 6 atmospheres in closed retorts. Treatment under this pressure for 4 to 5 hours will hydrolyse the protein into amino acids, which in the case of pea waste consists chiefly of glutamic acid. The acetic acid may then be distilled off and concentrated. The residue is neutralised with calcium carbonate to remove most of the sulphate, and, after filtering, the clear liquid may be concentrated *in vacuo* at about 45° C. to give a vegetable paste having strong flavouring properties. The taste of the extract is suggestive of meat, and may be used for flavouring soups or other food products.

The above suggestions may seem somewhat involved at first sight, but they are practicable. In contrast to most industrial fermentation processes, they have the excellent feature of not depending upon a pure culture, and, moreover, owing to the elevated temperature used (60° C.), there is little or no risk of spoilage from foreign strains of organisms, since the vast majority of bacteria, yeasts, moulds, and fungi are sterilised at this temperature.

[*The illustration is reproduced by courtesy of Food Machinery (M. and P.) Ltd.*]

CANNED ORANGE JUICE

"NOTHING is added; nothing is taken away" is the slogan used by the Stephens Packing Company, Upland, California, to describe the process which it has developed for canning orange juice. By the Stephens method, the fruit juice is packed orchard fresh without being cooked or frozen, and is sealed in the can within about 1½ minutes after extraction. The rapidity of the process is said to ensure retention of the original flavour and vitamin content of the juice.

Although the details have been kept secret, it is known that the juice is treated by combined mechanical and ultra-violet processes which "arrest oxidation of the juice when it is sealed in the cans." The juice goes under vacuum immediately after leaving the reamer, and is kept there most of the time until it reaches the cans. The juice is at 40° F. as it enters the cans, and as soon as the cans are sealed they are put through a warm bath, presumably to kill mould spores. On account of the mild temperature, the bath does not affect the flavour, it is asserted.

The Stephens process is said to be applicable also to other fruit juices.

CHERRY PRODUCTS

These articles describe processes employed for the preparation of glacé, candied, crystallised and maraschino cherries

Part I.

Storage and Bleaching.

CHERRIES ARE imported in the cask, paraffined fir casks being considered suitable for the purpose. The preservative is generally a "brine," consisting of SO_2 solution. Sometimes this is preceded by brining in a salt solution. Cruess makes the interesting suggestion that the term "brine" originated from the Italian practice of adding a little salt to the SO_2 storage solution with the object of meeting the tariff designation "brine," although, actually, the salt has no material action.

As considerable losses have been experienced from the cracking of the skins of the cherries and the softening of the flesh, work has been carried out in America in an endeavour to overcome these defects. Cruess recommends using a solution of 0·6 per cent. SO_2—*i.e.*, 5 gal. of 6 per cent. SO_2 solution to 45 gal. of water—and to this adding 0·3 per cent. of lime (calculated as unslaked)—*i.e.*, 20 oz. per 50 gal. of liquid. The lime is ground with water into a paste and mixed well with the SO_2 solution. The function of the lime is to harden the skins.

The cherries should be picked a few days before they are fully ripe. If gathered in cool, damp weather, they should remain in a dry place for seven or eight hours before barrelling, in order to lower their turgidity.

The cherries (stemmed, pitted, or "as picked") are filled into the cask (about 240 lb. to the 52 gal. cask—more may result in cracking) which is headed up. Fill completely with the SO_2 and lime solution and insert the bung. Roll the cask once or twice a day for the first ten days and replace any losses of solution. Store in a cool place.

Burtner recommends a 1½ per cent. SO_2 solution with 3¾ lb. of lime per 50 gal., although he prefers precipitated chalk (¾ lb.) to lime, and he says that the addition of tannic acid (½ lb. per 50 gal.) and magnesium sulphate (1¾ lb. per 50 gal.) improve the action of the lime or chalk.

Bleaching is usually completed in about ten days. The loss of weight of the fruit taken from the solution may be about 7 per cent.

It is better to stem, grade, and pit after bleaching.

The bleach is leached out by means of running water for about twelve hours.

Cooking.

The cherries are placed in a wooden vat fitted with a steam-coil or in a copper steam-pan. It should be noted that the presence of iron leads to discoloration. The fruit is covered with cold water, under the surface of which they are kept by a loose-fitting wooden raft perforated with holes. Gently raise the temperature of the water to boiling point and simmer until the cherries are cooked to the correct point, which is determined by experience. Some idea may be gained by removing a cherry from time to time, dropping it into a pot of cold water, and then eating it. The water should be occasionally skimmed.

When the cherries are considered sufnciently soft, heating is discontinued and the vat is allowed to cool. The cherries are then removed by means of a basket and drained.

Dyeing.

The cherries may be coloured during the cooking process or during the subsequent syruping operations. A drawback to the former method is that the cherries are liable to escape being coloured uniformly throughout, the skins being more coloured than the centres. One may use either Ponceau 3R or Erythrosine, or a mixture of the two, depending on the particular tint desired. Ponceau gives a brighter tint than Erythrosine and the latter introduces a bluish tinge.

H. B. C.

(To be continued.)

Green Lima Beans

Mr. Donald Barr, who has had extensive experience in the U.S.A. and Russia in the canning of fruits and vegetables, and who is now Technical Adviser to British Canners Ltd., describes the canning of Green Lima Beans.

OF THE canned vegetables which are served in the United States, Green Lima Beans have achieved a great popularity, for they possess a delicious flavour, have an excellent appearance, and are, of course, rich in vitamins.

There are two main varieties—the pole and the bush, or dwarf, variety. That most suitable for canning is the bush variety, usually the Henderson Bush Lima, which is a heavy yielder with a small seeded pod averaging 3 inches in length, and which reaches the stage of maturity most suitable for canning in sixty-five days after planting. As this bean is remarkably uniform in size and colour, the problem of careful grading is practically non-existent.

Planting and Cultivation.

The soil most suitable for growing Lima Beans is a light but moderately rich loam, which aids maturity. At the time of planting, the soil should be in good condition and fairly warm and dry if satisfactory germination of the seed is to result, as is required for bean seed of any type. The seed should be planted early in May—that is to say, about the same time as for other varieties of beans for canning. The time of planting is, of course, somewhat dependent, not only on local conditions, but on the date at which one's equipment is available for taking care of the crop. The rows are usually spaced 2½ feet apart, and the seed is dropped 6½ inches apart in the row. From 1 to 1½ bushels of seed are necessary per acre.

Careful cultivation to ensure control of the weeds and retention of the moisture is a necessity if the best results are to be obtained. Under normal conditions the beans are ready for harvest in sixty-five days after planting, when the immature seed has developed to a size enabling it to pass through a perforated screen of from $\frac{24}{32}$ to approximately $\frac{33}{32}$ of an inch and when its colour is green. Beans of a larger size usually begin to turn white and are not often young, tender, or succulent, and when canned are distinctly of a lower standard of quality. The yield varies, but the average is about 120 pots of unshelled beans per acre.

Harvesting and Canning.

The harvesting is done either by picking the pods from the vines or by cutting the vines with the pods still on them. The ordinary pea-podder or viner is used, except that the size of the screens is enlarged and the speed of the machine is reduced.

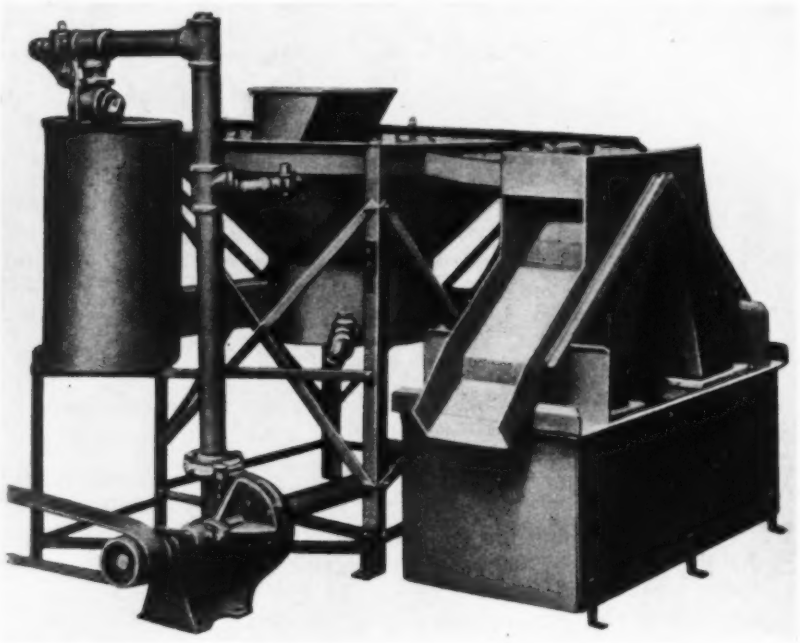
After removing from the pods, the operations of canning are much the same as for the canning of peas. To remove dirt, small bits of stone, and other foreign material, and to ensure thorough cleansing, some type of preliminary washer is used, such as the Olney washer.

From the washer the beans pass into the grading machine, where they are graded into from two to four sizes varying from $\frac{24}{32}$ to $\frac{33}{32}$ of an inch or over. However, if proper control of harvesting is maintained, it is possible to eliminate grading entirely, as the beans will all run fairly uniform in size. When graders are employed, an ordinary pea-grader with screens having perforations of $\frac{24}{32}$, $\frac{30}{32}$, $\frac{31}{32}$ and $\frac{32}{32}$ of an inch are used. By careful harvesting and eliminating the grading it is, of course, possible to increase the speed of production as well as decreasing costs.

After grading, the beans are blanched in a cylindrical pea-blancher for a period of time varying from two to five minutes at temperatures of 180° to 205° F. Beans are blanched to remove all occluded gases, to neutralise the colour, to shrink to the size they will occupy in the can, to remove any outer mucous material, to give better flavour, and to cleanse thoroughly.

Following the blanching process the beans are again washed before they are carried on to a white rubber picking-table, where women operators remove any broken or split beans, bits of skin, or any beans that have turned white in colour.

The beans are either filled by hand or with an Ayars pea filler, so that the net weight will be: Picnics, 5 ozs.; E1s, 9 ozs; A2s 13½ ozs. Brine is usually a 2 per cent. salt solution, and should be added to the can at as near boiling point as possible.



Grading Machine for Lima Beans.

(By courtesy of Food Machinery [M. and P.], Ltd.)

Closing temperatures should be 140° F. or over if possible.

The processes vary somewhat, depending on the maturity and the size of the bean used, but safe processes are:

Size.	*Initial Temperature.*	*Cooking Time.*	*Cooking Temperature.*
Picnic ..	140° F.	40 min.	240° F.
E1 ..	140° F.	45 ,,	240° F.
A2 ..	140° F.	45 ,,	240° F.

Immediately after cooking, the can should be cooled to a temperature not exceeding 100° F.

The outline given above deals primarily with the canning of Green Lima Beans and does not take into consideration the fresh, White Limas of larger size nor the processing of dried Limas. These are essentially winter operations, and the products cannot compare with the fresh Limas, which are of definitely superior quality for table use.

FOOD PATENTS

THE following is an interesting summary of the position with regard to the patenting of food substances. It is taken from the handbook *Patents and Trade Marks*, issued by Benjamin T. King, C.I.M.E.:

"In the case of inventions relating to substances prepared or produced by chemical processes, or intended for food or medicine, a patent will not be granted for the substance itself except when produced by the methods or processes described or by their obvious chemical equivalents. In other words, it is primarily the process that is patentable, and the substance is only monopolised by the patentee if it happens to have been produced by his particular method.

"Accordingly it follows that the process itself must essentially be new and original, and a real invention. As an example, let us assume milk in the form of a powder to be new; merely as a new form of milk, however, it is not patentable. But a process of spraying milk on to a hot cylinder at a certain temperature, drawing off the steam by a vacuum fan, and then scraping the solidified milk from the cylinder to form powder, would be patentable. Consequently the patentee could claim as his patent any milk powder when produced by his new way, but could not restrain others preparing it any other way, although (according to our assumption) he was the first to invent milk powder. The mere admixture of ingredients for foods or medicines—*e.g.*, a doctor's prescription or a cookery recipe—is not a patentable process, because obviously the process of admixture is not new and special or 'an invention.'"

NEW PRODUCTS FROM ENGLISH FRUITS

By

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The ways and means of preparing products such as syrups and wines from English fruit on a larger scale than that hitherto attempted, have claimed the attention of the author, working at the fruit research station near Bristol. The present series of articles, of which this is the first, will survey the results so far obtained.

CONSIDERABLE PROPORTIONS of the fresh fruit crops in this country are annually utilised for the manufacture of a variety of products of a more or less stable and permanent nature. A survey of these discloses two fundamental groups—the first composed of those made from crops grown specifically for the purpose (*e.g.*, jam, canned fruits), and, secondly, products made from such portions of the fruit harvests as are not suitable for the fresh fruit dessert market. Recent developments in packing and grading of fruits, together with the higher standard of quality, appearance, and general condition demanded by the present-day consumer, have caused the growers of soft fruits considerable anxiety on account of the impossibility of disposing of their surplus supplies at a price which will allow of even the most diminutive of profits. A certain proportion of fresh fruit is always unsaleable on account of its size and condition, and while modern conditions of fruit growing are gradually reducing some of the losses experienced, it appears to be certain that for many years there will be large quantities of surplus fruit available for the manufacture of suitable products. The occurrence of a glut crop is inevitably the occasion for unavoidable wastage on a large scale, and there is, at these times, an extensive supply of fruit which is capable of being turned into excellent syrups, beverages, and wines, each of which possesses, to a large extent, the health-giving properties of the original fruits.

The use of fruit crops such as has been described, whilst in no way detracting from the quality of the final product, provides the manufacturer with a low-priced raw material, a fact which should react favourably on the selling price and consequently on the appeal each product will make to the public. At the moment, it is impossible to give statistically exact figures to represent the tonnage of suitable fruit available under normal conditions. Certain it is that large quantities of soft fruit are allowed to waste each year for a variety of reasons, while, converted into stable and permanent products, this fruit could afford satisfactory profits both to the grower and manufacturer.

Many reasons can be adduced for the present period being regarded as particularly auspicious for the presentation to the public of a series of new products. Like the Athenians of old, the modern generation are constantly seeking after some "new thing." The phenomenal increase in the popularity of cider is a case in point. Doubtless the Chancellor of the Exchequer's addition to the beer duty two years ago played a large part in bringing cider to the public notice, but with the removal of that tax, which the cider makers could hardly be expected to regard as "iniquitous," the sudden swing of the pendulum back from cider to beer has not been experienced, and the former appears to have become firmly established. The wide advertisement now being given to cider, making use of such terms as "liquid fruit," "bottled sunshine," etc., appeals psychologically to the consumer, and the numerous health movements which appear to be having more than an ephemeral existence, by stressing the dietetic importance of fruit are doing excellent publicity work for such fruit products as are to be mentioned later. The health point of view of these syrups and beverages represents their chief advantage over similarly named synthetic products, and it would seem evident that some form of publicity in which this point would have special prominence will be a necessary preliminary to their widespread consumption.

In this introductory article it is intended to discuss in a general way the various products, while their detailed methods of manufacture will be referred to in a later article.

The products which will be fully discussed in later articles were prepared under a scheme carried out at the University of Bristol Agricultural and Horticultural Research Station at Long Ashton, under the supervision of the Director, Professor B. T. P. Barker, M.A.

Fruit Syrups.

The Northern European countries utilise large quantities of fruit for the production of fruit syrups. The syrups are adapted for table use as jellies (by addition of flour), as a sauce for puddings (*cf.* treacle or custard in England), as a "sweet" soup for children, and finally as a health food by cooking cereals such as barley, sago, and rice and serving cold with the syrup. In Germany a thriving commercial industry has been built up in the last 20 years for the manufacture of these products, while the recent rise of a fruit products industry in America

The Research Station Laboratories, Long Ashton, Bristol.

should serve as an impetus and challenge to the manufacturers in this country.

Biological determinations of the various vitamins in fresh fruit juices show that the most prominent accessory food factor is vitamin C, which is found in considerable quantities in the following fruits: Apples, blackberries, currants, raspberries, strawberries, plums, and tomatoes. (Pears contain only small amounts of vitamin C.)

Vitamin A, necessary for growth and allied physiological processes, is abundant in tomatoes and in smaller amounts in apples and strawberries.

The stability of vitamin C is entirely dependent on the absence of oxidising agents and air, and the conditions of acidity or alkalinity of the medium exert a remarkable effect on the deterioration of the vitamin. From the published literature it appears that vitamin C is not affected by moderate heat treatment (*cf.* canned apples, tomatoes, and strawberries, all of which contain this vitamin), but excessive aeration is likely to affect adversely both vitamins A and C. The various processes concerned in the manufacture of syrups, etc., must be reviewed in the light of this important fact.

Syrups are extremely adaptable products and may be used in a wide variety of ways.

The concentrated syrup (60 per cent. sugar) or the 45 per cent. sugar syrup may be sold to domestic purchasers for use in one of the ways mentioned above. An easy and effective means of using syrups in the home is to dilute with water and carbonate in a sparklet siphon or with soda water, when a refreshing alcohol-free beverage is produced. Excellent water ices may be made by freezing a quart of syrup diluted with 50 per cent. of water, and adding either gelatin or egg white. Again, fruit syrups may take the place of a portion of the sugar used in cream ices, and a whole series of excellent products has been obtained by this means. Utilisation of syrups on a commercial scale will probably find widest scope in the production of non-alcoholic juices. For these, 45 per cent. sugar syrup (45° Balling) is the best material to use as a base. Provided that heat treatment has been discouraged as much as possible in the various processes, these juices, when carbonated and bottled, are attractive in appearance, aroma, and flavour, with the delicate bouquet of the fresh fruit easily distinguishable.

In this manner, loganberry and raspberry syrups of a distinctive nature are obtained, while the field is open for almost unlimited blending of the various fruit juices, and the production of a "non-alcoholic liqueur," with a kaleidoscopic succession of flavours reminiscent of the more familiar liqueurs of monastic origin, is by no means an impossibility.

Fruit Juice Concentrates.

The preservation of fruit juices by concentration has been applied largely to the apple and the grape. Concentrated apple juice is exported from Germany, France, Switzerland, U.S.A., and Canada, the latter supplying this country with by far the largest bulk. The concentrate is largely used for cider manufacture, but non-alcoholic apple juice is also made on a fairly large scale from this material. It has been shown at Long Ashton that other fruit juices can be similarly concentrated, and if the process is carried out at a suitably low temperature and with a correspondingly high vacuum, the products are satisfactory and can be used in exactly the same way as syrups. The latest developments in the preparation of concentrates of an improved quality—*i.e.*, by freezing—will be discussed in a later article.

The question of "concentrate *versus* syrup" is of some technical interest. The formation of a syrup from a juice results in a considerable dilution of fruit flavour, while concentration is effected by a mere removal of water and a small amount of volatile esters, etc., which contribute to the aroma of the juice. Volume for volume, concentrates are more fruity than syrups of similar strength, and this point may have an important bearing on the utility of the two methods of treatment.

Fruit Wines.

Germany has long been the home of fruit wines, and quite a considerable industry has been gradually built up in these products. Alcoholic beverages similar to the main categories of German grape wines—viz., sweet and dry (with high and low alcohol contents), and heavy dessert table wines—have been made. As a rule, it is difficult to obtain more than 10 to 12 per cent. of alcohol by direct fermentation of a fruit juice fortified with sugar,

and consequently 12 per cent. represents the higher limit of alcohol usually found in this type of wine. The lower strength wines are generally fermented until 7 to 8 per cent. of alcohol is present, and further fermentation prevented by filtration through paper pulp.

In England, part of the surplus fruit of the cottagers in rural districts has been, for over 300 years, made into wines. Worlidge, in his *Vinetum Britannica* (1678), ecstatically guides his readers through a variety of recipes, processes, and products, many of which have not been surpassed in the intervening centuries. In rural districts to-day, large quantities of fruit wines are produced, some of which, it must be admitted, should be taken rather as medicines than as wines, but the vast majority are of such a quality that English home-made wines have established a well-deserved reputation for general excellence.

Fruit wines are not prepared commercially on any scale, with the exception of a rhubarb wine whose manufacture is localised around Leeds, but it is suggested that the commercial production of fruit wines should prove a profitable undertaking, if the factory is suitably situated near a fruit growing centre, where a supply of fruit is readily available.

A natural extension of the idea of fruit wines is the production of spirits, for use alone or in combination with the appropriate syrups to form a liqueur. Excellent brandies (46 per cent. alcohol) have been produced from low-grade apple juices, while most highly flavoured soft fruits such as strawberries, loganberries and raspberries have provided at Long Ashton a series of attractive liqueurs with delicate bouquets and smooth flavours. In this class, there are two analogous products made in France which have achieved a considerable degree of popularity. Cider brandy, otherwise known as Calvados, finds a ready sale, while blackcurrant syrup, fortified with the spirit distilled from blackcurrant wine, is sold in large quantities as "Cassis."

CONFECTIONERY STANDARDS

DEFINITIONS of products are not favoured by the majority of manufacturers in this country. It is argued that such regulations lead to sameness and a lack of appreciation by the public of degrees of quality above the stipulated minimum. Against this it must be admitted that the consumer on occasions would benefit by the fixing of standards of minimum quality.

The tendency in U.S.A. is to fix definitions for practically every saleable product. In fact, this is carried out to such an extent that it is easy to become bewildered, particularly when first exporting to that country, in the maze of regulations which exist. The writer will always remember the consternation once caused by the receipt of a cable advising the holding up of a large consignment of sweets known as "—— Fruits" on the ground that they were not natural products.

While a few judicious rulings of a more or less general nature can be extremely helpful in guiding manufacturers, no one wishes for involved and hampering legislation, excepting possibly a few public analysts with a limited knowledge of actual factory methods and difficulties.

Ignoring any possible legal applications, the latest book by Dr. E. S. Jordan* is valuable to confectionery manufacturers, for he deals with standards of raw materials and of finished products to which every wise manufacturer endeavours to conform. The work commences with a consideration of the necessity for standards and then goes on to review the raw materials used in the industry, various classes of confectionery, labelling and branding, familiar adulterations, and concludes with an appendix covering various regulations and legal cases encountered in U.S.A.

In each section, when dealing either with a constituent or a finished product, Dr. Jordan has given a comprehensive résumé of the characteristic properties of the material under discussion, and then suggests a suitable definition to ensure that a satisfactory minimum quality standard will be maintained. Chemists will be interested also in the instructive analytical notes which are included with each material reviewed.

From a manufacturing point of view these definitions are extremely valuable, as they are arrived at after a clear and careful consideration of what is expected by the public and—possibly more important—what can reasonably be produced by the manufacturer.

The descriptions of the confections, while of course being technically accurate, are given in language which can be easily understood by the non-scientifically trained confectioner. The characteristics of each class are well brought out and most useful comparisons made.

The standards tentatively suggested are worth the study of every manufacturer, if only to reassure himself that his own products are up to the mark and not in any way misbranded. A few (unfortunately there still are a few) can gain some idea of the desirable constituents of confectionery, the use of which does not tend to bring the whole trade into disrepute.

A work of this nature is controversial, for every reader will not necessarily agree with the proposed standards of quality suggested by the author. Nevertheless, the book is stimulating in its surveys, ideas, and recommendations. It is not exactly a textbook, for it is far more interesting than are such books, but after the first reading it will be referred to again and again.

HAROLD MORGAN.

* *Confectionery Standards*, by Stroud Jordan, M.S. Ph.D., Applied Sugar Laboratories, Inc., New York, 1933. 370 pages. Price $5.

FRUIT CANNING IN NEW ZEALAND

NEW ZEALAND, by virtue of its soils and climate, is admirably adapted for the production of temperate zone fruits. In both islands apples, pears, plums, peaches, nectarines, apricots, cherries, quinces, strawberries, gooseberries, red and black currants, and raspberries grow readily and yield prolifically. Moreover, in the Auckland Province, in addition to most of the above mentioned, citrus, guavas, tree tomatoes, loquats, passion fruit, and other sub-tropical fruits thrive. Bearing in mind that New Zealand has been settled for scarcely ninety years, and that its colonisation proceeded on such lines as required each settler to be as completely self-sufficing as possible, long before fruit-growing on a commercial scale was commenced small orchards were established at almost every homestead.* This state of affairs still continues, and hence throughout the rural and suburban districts, and in many of the urban areas also, each house has its small orchard, which is drawn upon by the housewife for fruit, both for immediate use and for bottling. Preservation of fruit by bottling is in consequence widely practised in homes throughout New Zealand, and it will be realised, therefore, that this reduces, to a marked extent, the demand for canned and bottled fruits purchased through retail shops.

The population of New Zealand in 1932 was estimated as totalling 1,525,000, a number which may be compared with the population of Sydney or of one suburb of London. Of this total some 52 per cent. constitutes what is termed the urban population, which is defined as that portion of the people which dwells in towns of over 2,500 inhabitants. It may therefore be concluded, when all the foregoing facts are taken into consideration, that the potential demand for canned fruits will come from a total of rather less than some 500,000 purchasers in New Zealand. Moreover, these possible purchasers will always be within easy distance of sources of supply of fresh fruit during the whole of the year, either direct from orchards or from cold storage depôts. In addition, there is a large regular trade in oranges, bananas, tomatoes, and other semi-tropical fruits from the Pacific Islands.

Supplies of Raw Material.

It is a most difficult task in New Zealand to secure reliable figures relative to the annual production of fruit. The following figures taken from statistics published in 1929 may, however, be considered as indicating, in general, the approximate extent of the fruit yield from commercial orchards:

Apples	2,200,000 bushels
Pears	245,000 ,,
Peaches	125,000 ,,
Nectarines	18,000 ,,
Apricots	76,000 ,,
Plums	64,000 ,,
Cherries	10,000 ,,

No particulars are available concerning the yields of such small fruits as gooseberries, black and red currants, strawberries, cape gooseberries, passion fruit, tomatoes, etc., which may be availed of in the canning industry. Similar conditions apply to those vegetables which also figure in the canning industry.

It may, however, be reckoned that expansion of production of every class of fruit listed above could readily be brought about in New Zealand, for its soil and climatic resources are admirably suited for the purpose, and are, as yet, but imperfectly exploited. During the past ten years the total export of apples and pears for the whole of the Dominion has increased ten times. For individual districts in some instances the increase has been much greater. So long, however, as the limitations of marketing imposed by the small local population prevail, and it remains impossible to process fruit to sell at a competitive price in the world's markets, then expansion will not take place in production. It too often happens that growers to-day are faced with gluts, and the production of fruit is carried on at a loss. For example, bushel cases of sound tomatoes have in the present season been sold on the markets for as low as 1s. to 1s. 6d. Bushel cases of

Apple Orchard, Hawke's Bay.
(From the Collections of the Imperial Institute.)

* A total of over 5,000 acres of non-commercial orchards has been revealed by census returns, and of course this does not take into account the large aggregate area occupied by the very small orchards which are found in the sections attached to almost every suburban and rural dwelling.

dessert apples, too, have been sold for the same figure at the orchards, and it has been possible to purchase peaches and nectarines in the retail shops of Wellington, some 400 miles from the source of supply, for 3d. to 6d. a pound.

Trade in Canned Fruit.

Statistics show that the imports of canned fruits are, during the latest three years for which information is available, declining. In 1929, 506,000 dozen of all kinds were imported, but in 1931 the total had dropped to 364,000 dozen. In 1931 the imports were valued at £93,572. In view of the fact that more than half of this total represented peaches and apricots, for which local provision has been, and is being made since, the total value and extent of the imports are likely to decline still further, unless a marked expansion takes place in the importation of tropical canned fruits which, themselves, cannot be grown in New Zealand. Of these latter the most important will probably be pineapple, which for many reasons was particularly attractive to the New Zealand canned fruit buyer, and was, in consequence, extensively used. At the present time supplies are drawn from Malaya, Fiji, and Hawaii, which provide a total of 183,000 dozen cans of a total value of £29,160.

The following table gives an indication of the nature, amount, and value of the canned fruits imported to New Zealand. The figures are taken from official statistics for 1931:

	Dozen.	*Value.*
Apricots	45,531	£16,384
Peaches	127,836	43,535
Pears	3,390	1,330
Pineapples	183,765	29,160
Others	3,302	3,163
	363,833	£93,572

A perusal of these figures will occasion some surprise because of the conspicuous places occupied by peaches and apricots, which are readily grown in New Zealand. This may be partly explained by the fact that the New Zealand orchardist naturally looks to sell the most of his crop on the fresh fruit market, and does not cater for the canners. This is particularly true of peaches, and one of the largest canning firms has been obliged to establish its own orchard to grow those particular varieties which it required, because satisfactory fruit in ample quantity was not available from local growers. The varieties of peaches particularly sought after for canning purposes are Golden Eagle and Golden Queen. The majority of the peaches and apricots are grown in Central Otago and Hawke's Bay, and are somewhat remote from canning factories. This will be overcome shortly by the erection of another factory in Otago, which will deal particularly with apricots and peaches grown in that province.

The following table shows the main sources of supplies of imported canned fruits in 1931:

	Apricots.	*Peaches.*	*Pears.*	*Pineapples.*
	(Dozens.)		*(Dozens.)*	
South Africa ...	3,672	250	—	—
Canada	39,901	—	—	—
Australia ...	43,573	123,840	3,100	—
U.S.A.	1,958	3,746	—	—
Malaya	—	—	—	175,120
Fiji	—	—	—	6,742
Hawaii	—	—	—	1,195
	89,104	127,836	3,100	183,057
Values	£16,384	£43,535	£1,330	£29,160

It is unlikely that any extensive export trade in canned fruit will be established until the costs of the raw product are considerably reduced. In New Zealand it must be remembered that the cost of land suitable for fruit production is high, that labour is costly, transport charges heavy. This combination of circumstances weighs heavily against the development of an export trade, especially as New Zealand is geographically isolated from possible consuming centres of population. Internal transport charges and the scattered distribution of the

Espalier Apples Growing in New Zealand.
(By courtesy of the High Commissioner for New Zealand.)

Grape Fruit Growing in Helensville, North Auckland.

(By courtesy of the High Commissioner for New Zealand.)

fruit-producing areas in New Zealand also add to production costs. Probably any one of the larger factories could, with its present equipment, provide for the whole of the New Zealand demand were it possible to work for a longer period each year and to draw upon satisfactory supplies in its proximity. Despite the fact that the larger factories are now all associated with the Australian firm of Henry Jones, Ltd., it has been impossible to avoid a certain amount of unnecessary duplication of plant and machinery.

Factories—Production Methods, etc.

In New Zealand the fruit preserving and jam making industries are combined in the same factories. Eleven such factories were in operation in 1932, the number having increased from seven in 1930. Five of these factories are located in Auckland, and two in Nelson, Canterbury, and Otago respectively, these being in proximity to the main fruit-growing areas of the Dominion. Those factories located in Auckland and Nelson operate on a much larger scale than the southern works, and in 1932 produced some 20,150 cwt. of preserved fruit valued at £38,000 out of a total Dominion production of 21,081 cwt. valued at £40,600. The value of the canned fruit amounted to about one-seventh of the value of the total production of the works.

The attached tables give a statistical summary of the nature and extent of the fruit preserving and jam making industries of New Zealand, compiled from official figures.

It will be seen from perusal of these tables that the industry is steadily expanding, and that there has been a marked increase in the output of canned products. New Zealand factories at present can apples, blackberries, black currants, fruit salad, greengages, gooseberries, loganberries, passion fruit, peaches, pears, raspberries. In addition, green peas, tomatoes, and a limited amount of other vegetables are also treated, but the local demand for these in New Zealand is very restricted.

The present factories have thoroughly up-to-date equipment, the larger works having adopted automatic grading, peeling, slicing, cooking, and lidding machines, the whole factory design being laid out to allow of a continuous flow of products from the receiving stage to the final packing for despatch or storage. Both the open bath and the closed retort methods are in use, while continuous pressure steam cookers are also installed in some of the works. A good deal of attention has been devoted to factory design and to the type of equipment which will enable the most complete measures to be taken to ensure the utmost cleanliness so essential to the preparation of a high-class product.

Each works manufactures its own metal containers in the special department set aside for the purpose. The 30-oz. metal container is the most popular size made, though others of 16-oz., 3½-lb., and 6-lb. capacity are also manufactured.

Glass containers are used only to a very limited extent. A marked feature of all the New Zealand factories is the very attractive designs adopted for the labels used on the containers. These labels possess a distinct artistic merit, and, moreover, have to conform to the very strict provisions of the New Zealand Foods and Drugs Act.

Tariffs.

The New Zealand fruit canners have the protection of special tariffs at present:

(*a*) A general tariff of 50 per cent. *ad valorem*.

(*b*) A British preferential tariff of 25 per cent.

FRUIT PRESERVING AND JAM MAKING

Table showing the number and character of organisation of fruit preserving and jam making establishments in operation at March 31, 1932, giving particulars as to the persons engaged and motive power employed, salaries and wages paid, other expenses of operation, materials used, products for year ended March 31, 1932, and approximate value of land and buildings and machinery and plant.

Provincial District.	Number of Establishments.	Total Persons Engaged.		Salaries and Wages Paid to—		Expenses of Operation other than Salaries and Wages and Cost of Materials.	Total Horse-Power Available.
		M.	F.	M.	F.		
				£	£	£	
Auckland	5	199	191	42,841	10,806	26,294	181
Nelson	2						
Canterbury	2	29	22	4,272	1,155	1,867	37
Otago	2						
Totals, 1932	11	228	213	47,113	11,961	28,161	218
„ 1931	10	201	151	50,822	12,306	28,563	214
„ 1930	7	181	117	44,624	10,359	22,723	179

Materials Used.

Provincial District.	Fruit.		Sugar.		Imported Pulp.		Other Ingredients (Cost).	Cost of Bottles, Labels, Covers, Cases, etc.	Cost of other Materials Used.	Total Cost of Materials Used.
	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.				
	Tons.	£	Tons.	£	Tons.	£	£	£	£	£
Auckland } Nelson } ...	3,802	64,460	1,714	26,423	57	1,714	17,709	47,218	4,484	162,008
Canterbury } Otago } ...	61	7,864	688	12,590	—	—	648	1,363	107	22,572
Totals, 1932 ...	3,863	72,324	2,402	39,013	57	1,714	18,357	48,581	4,591	184,580
„ 1931 ...	3,539	69,067	2,357	42,040	107	3,120	21,130	55,045	4,358	194,760
„ 1930 ...	3,219	66,715	1,997	40,119	25	813	11,184	47,889	1,500	168,220

Products.

Provincial District.	Jams and Jellies.		Fruit Preserved in Cans.		Fruit Pulped.		Candied Peel.		Value of other Products.	Total Value of all Products.	*Approximate Value of—* Land and Buildings.	Machinery and Plant.	Total.
	Quan.	Value.	Quan.	Value.	Quan.	Value.	Quan.	Value.					
	Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£	£	£	£	£	£
Auckland } Nelson } ...	41,433	131,089	20,150	37,873	25,912	30,272	1,627	7,345	67,002	273,581	59,668	29,642	89,310
Canterbury } Otago } ...	10,217	27,418	931	2,699	100	134	428	1,869	107	32,227	4,050	3,885	7,935
Totals, 1932 ...	51,650	158,507	21,081	40,572	26,012	30,406	2,055	9,214	67,109	305,808	63,718	33,527	97,245
„ 1931 ...	54,657	165,655	20,399	45,691	16,086	29,337	2,267	9,220	80,619	330,522	57,026	29,929	86,955
„ 1930 ...	48,240	158,637	16,684	55,016	17,143	24,738	1,832	8,465	53,465	300,424	46,255	25,624	71,879

The BACTERIOLOGICAL EXAMINATION OF CANNED MEAT

By THOMAS McLACHLAN, A.C.G.F.C., F.I.C.
and
MARGARET IDA STERN, B.Sc., A.I.C.

The following article places on record the conclusions arrived at by the authors as a result of extensive and varied experience in the bacteriological examination of canned meat.

THE PAST few years have witnessed a complete revolution in the method of food preservation in this country, and the canning industry, which was first introduced here over a century ago, has recently grown at a tremendous rate. While it is comparatively easy to sterilise certain goods, notably acid fruits, or products in small containers such as meat and fish paste, with others such as fish, soup, or canned gammons, there is great danger of rendering the product inedible before effecting sterilisation.

There is a common belief among many manufacturers, and even their chemists, that the only test for sterility that need be employed is to incubate a certain percentage of cans for about a fortnight, and then to open them and see if the product, be it fruit, vegetable, fish, or meat, appears sound. Within certain limitations this is perhaps correct, but in the main it is distinctly unreliable. We have had cans of meat which have been incubated for a month and still they appear sound, but when the incubation has been continued for another week they have suddenly blown. Esty and Stevenson, discussing the subject of the incubation of canned goods, comment on Savage's record that he incubates for several weeks and state that four to seven days should be sufficient. We find that we are unable to agree with Esty and Stevenson that this period of incubation is sufficient, as there may be only a few bacteria present in isolated spots in the can, and although these develop into colonies they do not spread throughout the contents in this time. In our experience it is impracticable to mix meat properly to average sampling under strictly aseptic conditions; foreign bacteria are almost invariably introduced if attempts are made to cut up large pieces of meat, and it is therefore better to see that any bacteria present spread themselves throughout the contents before opening. It is then found, whatever portion of the contents is sampled, if bacteria are present, some are bound to be taken. We are therefore of the opinion that the longer period of incubation suggested by Savage and his co-workers is more satisfactory. It is, however, obvious that, once a can shows signs of blowing or any other external indication that the contents are no longer sound, there is no necessity for further incubation, except for research purposes.

There is a common and growing belief that many cans of food have gone bad due to the growth of bacteria in the can, but that when the decomposition has reached a certain stage the bacteria have suddenly died out. This belief, we think, is largely fallacious. While it is probable that in some of these cans the bacteria have died out, in the majority they have merely become very highly attenuated and find it difficult to grow on ordinary media as usually employed. We have, ourselves, examined cans of meat from the same cooking as other bacteriologists, where the report has been that the decomposition was caused by bacteria, but that they have died out. Our argument against the theory that the bacteria are likely to die out, apart from the fact that we have isolated them alive, is that the bacteria we isolated were spore-forming bacteria, which would spore and not die readily, and that in a medium such as meat, even if they did die, they would tend to autolyse. This belief is probably a remnant of the old idea concerning milk, that it curdles owing to the action of bacteria, but that when the acidity has reached a certain stage, the bacteria die and moulds start growing until sufficient alkali has formed to enable bacteria to re-establish themselves, and that this time putrefactive bacteria take charge of the situation. Carried to its logical conclusion, this argument will not hold water, since the moulds which suddenly start to grow must be present originally, and the putrefactive bacteria are not formed by the transmigration of souls from moulds. In other words, whether, owing to the preponderance of other forms of growth, certain species can be isolated or not, is largely a matter of mass action and conditions affecting their isolation.

Apart from these considerations, the idea of incubating

cans and deciding whether a particular batch is satisfactory or not without carrying the investigation any further, is decidedly unsatisfactory. There may be several causes for certain batches being unsound, and without proper bacteriological control it will be impossible to trace them. The lack of sterility may be due to purely extraneous causes, confined to a particular batch of material; it may be due to consistent under-sterilisation, to irregular heating in the retorts caused by bad packing or other causes, or to the gradual development of putrefactive bacteria in the cannery as a whole, which if appreciated in their early stages could be summarily dealt with. In connection with the last sentence, it may be claimed that sterilisation should be such that any bacteria of the putrefactive type would be automatically destroyed, and that the conditions under which a cannery are run should be such as to prevent the possibility of toxins from bacteria of the Salmonella group or the bacteria themselves being present, but anyone with experience of canning knows that certain packs have to be so sterilised that very few spore-forming organisms are destroyed, once spores are present. This remark applies particularly to certain large cans of pickled meats.

Examination of Meats.

The cans are incubated at blood heat and in the laboratory, for a period of up to one month, those incubated at blood heat being shaken occasionally to distribute bacteria throughout the contents of the can. Needless to remark, the cans should also be watched for the development of gas, otherwise if one bursts in the incubator or the laboratory it may make its presence felt in an undesirable manner.

The media we have generally employed are those described by Savage, and Hunwicke and Calder in their Report, "The Bacteriology of Canned Meat and Fish," and consists of egg meat medium (grown aerobically and strictly anaerobically), lactose and glucose McConkey and nutrient broth, agar, and gelatine. The nutrient broth, agar, and gelatine are invariably clarified with egg, since we believe that this may be of assistance in the isolation and growth of attenuated bacteria. Since most bacteria like a mixed medium, we are of the opinion that traces of certain proteins and salts contained in egg and left in the medium after clarification are liable to encourage the growth of bacteria rather than some of the almost synthetic diets at present employed. We also agree with Savage that, unless obvious bacteriological growth is present, as large a portion of the sample as possible should be introduced into each tube. If a mixed infection is suspected, portions of the sample are placed in sterile bottles containing sterile saline or distilled water and plated out aerobically and, if necessary, anaerobically.

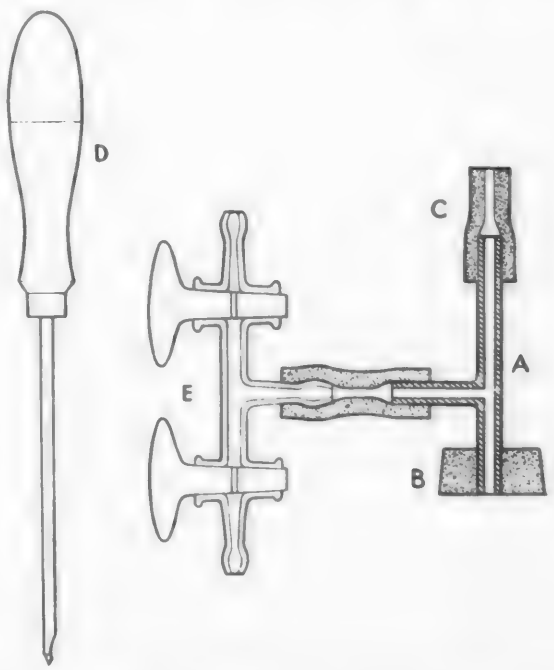
These points are discussed before dealing with the opening of the sample, since it is usual to prepare one's media, plates, etc., before opening the sample, and, therefore, this appears to be the most logical procedure.

After removal of the cans from the incubator they are thoroughly cooled, particularly if gas be present, otherwise there may be difficulty in flaming the outside of the can properly before opening. This procedure has the advantage that if the jelly will still set there is not so much risk of a spill. The cans are opened at the bottom in order to obtain samples as free as possible from fat, and the method of opening depends on whether gas is to be determined or not.

Examination of Gas.

H. A. Baker, Eighth International Congress of Applied Chemistry, 1912, describes an apparatus for drawing off the gas from cans, using an extensible strap iron frame in which the can is set. A hollow steel needle enters at the base, with a rather similar arrangement to ours at the top, but he injects water at the base of the can in order to eject the complete amount of gas at the top and collects the gas over water. This has the disadvantage that the contents of the can cannot afterwards be employed for bacteriological examination, and much of the carbon dioxide is probably absorbed in the water. Savage and Clark, University of Washington Publications in Fisheries, 1925, employ a stab rather similar to ours, but run their gas direct into a gas burette again collecting over water. These authors also employ a similar frame in which to hold the can, but we have found that, with the large variety of cans handled in a laboratory such as ours, a clamp is of little assistance, and that with large cans in particular most of the gas may be expelled by simple hand pressure.

For the collection of gas from cans we have found the device shown in the illustration very efficient. It consists essentially of a stainless steel **T**-piece fitted at



Device for the Collection of Gas from Cans.

one end of the cross-piece with a single-bored rubber bung which projects slightly beyond the steel tube, and at the other end with a piece of narrow bored pressure tubing. Passing through the pressure tubing is a stab, which fits tightly so that no gas can escape and which has a sharp point at the end. Immediately behind the pointed end the steel is ground away for half of the cross-section of the rod to allow of the passage of gas. The rubber tube is adjusted so that the point of the stab is in line with the surface of the rubber bung. The bung is placed tightly against the surface of the can, and by pressing the stab a puncture is made, and on releasing the stab gas passes readily up the steel tube. The branch of the **T**-tube is attached to the branch of a glass **T**-tube fitted with taps on each arm, so that gas may be led directly to the gas apparatus and any surplus collected in a cylinder, over brine more or less saturated with CO_2. The gas sampling tube and stab are sterilised by standing in methylated spirit for about an hour and then flaming thoroughly to burn off all spirit, the actual puncture being made while the stab is still hot.

The cans themselves are sterilised in the usual manner by cleaning with alcohol and finally by burning alcohol on the surface which is to be opened. The can is opened with a sterile tin-opener, of the cutter type in the case of meat or fish, under the seaming. If a gas sample has not been taken a flame is held against the can when it is opened, in case any air may be sucked in, though the heating of the can before opening frequently prevents this.

Method of Sampling.

Where the meat is surrounded by liquid, either intentional or through liquefaction, it is useful to take samples under sterile conditions by means of a sterile pipette, and it will usually be found that the liquid contains some of all types of bacteria present in the can. Where the meat is solid, or composed of small pieces held tightly together, we have found that the simplest method of extracting samples from the interior is by means of a sharp sterile cork borer. In order to eject the sample we use a solid tube of the cork borer type to press it out. For use the plunger is inserted into the tube before sterilisation, and as the borer is pressed into the meat the plunger rises inside. Portions of meat may be cut off by a sterile knife and dropped into the media tubes. Care is always taken to obtain samples more or less free from fat for inoculation.

Other authors have dealt with the various bacteria which are usually associated with spoiled canned foods, so that there is little to be gained by our repeating the information. It is, however, well known that canned gammon of ham is never sterile, the conditions of canning being such as to prevent sterilisation, and we think it may be of interest to readers to have the following particulars of three different spore-forming bacteria commonly associated with canned gammon.

CHARACTERISTICS OF BACTERIA

	A.	*B.*	*C*
Agar plate ...	Spreader	Round white colonies ...	Translucent colonies
Gelatine stab 21° C.	Villous growth. Liquefaction	Liquefaction (very slowly)	Saccate liquefaction
Gelatine stab 38° C.	Liquefaction	Liquefaction	Liquefaction
Meat and egg anaerobic medium	No apparent growth	No apparent growth	H_2S odour after some time
Broth	Pellicle, thick and wrinkled, after short incubation	Soft, friable pellicle after few days	Thick wrinkled, pellicle after short incubation
Glucose McConkey	Acid, no gas. Very good growth	No acid or gas	Acid, no gas
Lactose McConkey	Acid, very slowly, no gas	No acid or gas	Acid very slowly
Morphology of bacterium	3μ by 5μ (rather thick). Tendency to form chains and parallel bacilli	2μ in length. Tendency for parallel formation. Short thick rods, rather smaller and thinner than spreader	2μ in length. Short thick rods
Spore characteristics	Subterminal or rather central. Spores quickly (after about 5 days subculturing)	Tend to be subterminal, spores more slowly than spreader	Oval terminal spores. In old culture appear just as oval spores
Gram stain ...	Positive	Positive	Positive
Length of incubation of cans	16-21 days	15-21 days	15-21 days

Although we have described the above bacteria and stated that canned gammons are never, in our experience, sterile, it might be well to mention that, provided the canning is carried out satisfactorily, there need be no fear of any bacteria foreign to the pickle being present.

HONEY-FLAVOURED BREAD

FORMERLY consumed only in the comb or as a pure strained product, honey is now becoming popular in the U.S.A. as a flavouring and sweetening agent for other foodstuffs.

One of the latest honey products is the Honey-V bread baked by the Huber Baking Company, Wilmington, Delaware. Pure honey comprises the only sweetening agent used in the manufacture of this bread, and the product is said to take on a very distinct and delightful honey flavour.

THE PRESENCE OF TIN IN FOOD PRODUCTS

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CONSIDERABLE ATTENTION was given a short time ago to the question of aluminium in food products. From a survey of the literature it was shown that the evidence was definitely against the possibility of toxic effects being due to this metal. A similar treatment of the subject of tin in foods would appear desirable. It is clearly of paramount importance for the canning industry that any criticism regarding the presence of small amounts of tin should be met, if possible, with conclusive proofs of its harmlessness.

The Sources of Tin in Foodstuffs.

Tin appears to be a normal constituent of animal tissue. Bertrand and Cuirea,[1] in an examination of beef, horse, and mutton tissue, found from 0·5 to 4 mgm. of tin per kilo of fresh material except in the skin (6 to 9·5 mgm.), in the tongue (12 to 16·5 mgm.), and in the tongue mucous (18·6 to 26 mgm). In the human organism Misk[2] found amounts varying from 5·9 mgm. in the brain to 137 mgm. per kilo in the liver and spleen. From this and other tests he concluded that tin was a normal constituent of human viscera for which allowance should be made in toxicological analysis. By spectrographic methods traces of tin have been found in fish,[3] regularly in human and cows' milk,[4] and in the ash of human blood and organs.[5]

The main sources of tin in food products are containers, such as cans and bottle caps, the use of tin or tinned vessels for manufacture and storage, and the use of tinfoil as a wrapping. In this country metal tubes of the toothpaste type are becoming better known as containers for food products, and may provide a further source of tin. It has been shown by Elten,[6] Manley,[7] Dyer and Taylor[8] that cheese packed in metal foil may become contaminated with tin (and antimony). Of thirty-five samples examined, Dyer and Taylor found seven to contain more than 2 gr. of tin per pound., the maximum being 5·5 gr. Manley reasonably pointed out the desirability of protecting cheeses of the Gruyère type from the action of metal foil. It is interesting to note that in March, 1932, Mr. Thorne asked the Minister of Health whether a number of poisoning cases were attributable to foodstuffs wrapped in tin or lead foil, and whether he would consider the advisability of issuing an order that the immediate wrapping of foodstuffs should be greaseproof paper or cellophane. In reply it was stated that, apart from one unverified case, there was no information that tin or lead foil had been the cause of food poisoning, and in these circumstances there was no justification for making the order suggested.[9]

Cans undoubtedly provide the greatest source of tin in foods, and its presence has been recognised for very many years. Hehner in 1880 and Wynther Blyth in 1883 reported on the tin content of various canned goods in the *Analyst*. The corrosion of cans usually increases with storage, especially at elevated temperatures. Food left in an opened can may also show an abnormally high tin content. Mantell[10] distinguishes three main types of corrosion: (*a*) Discoloration due to sulphides, sometimes also to tin oxide, particularly with restricted oxygen; (*b*) perforation resulting in the formation of holes in the can caused by electrolytic action; and (*c*) "etching," due to solution of the tin by the contents of the can. The latter corrosion by organic acids may precede or occur with electrolytic action. The question of the corrosion of cans is complicated by the fact that there are substances which act as accelerators and others as inhibitors of corrosion. Sulphur compounds—sulphides and sulphites—in acid solution may act as accelerators, and colloids like agar and gelatin as inhibitors.[11] Corrosion is favoured by the presence of air in the can and by exposure of the steel base of the plate, due to a break in the tin coating. Electrolytic action occurs at the junction of the tin and iron, and the solution of either or both metals is considerably accelerated. From American work it appears that in acid solution iron is at first the anode and corroding metal, but a reversal of current rapidly occurs, tin then becoming the anode.

Various methods have been proposed for the detection of defects in the tin surface of plate, but the use of Ferracco[12] paper offers advantages in giving a permanent record. The surface of the tinplate to be tested is first washed with soap and water to remove grease. A piece of Ferracco paper is placed on the plate, and the back is thoroughly wetted with distilled water. After two or three minutes the paper is smoothed out to remove air bubbles and is left in contact with the plate for about

twenty minutes. The paper is then peeled off, washed in two changes of warm water, and is suspended to dry. Defects in the tin coating of the plate, exposing iron, are shown by blue marks on the paper. Care must be taken that the paper does not come in contact with any other iron substance during testing and washing.

To overcome the difficulty of high tin content through long storage, the dating of cans has been recommended, but, unless in code, this has obvious disadvantages from the manufacturers' point of view. In general, the corrosion of cans may be very considerably reduced by lacquering, and this would do much to counteract the effect of prolonged storage. A possible objection is that with acid products perforation and hydrogen swell difficulties may be greater with lacquered than plain cans, and with tomato purée the colour may be inferior in lacquered cans. Adam,[13] as a result of several hundred analyses, considers that a sound lacquer coating is of great assistance in keeping the tin content at a low level. He stated that with a fruit pack in sound double-lacquered cans the tin rarely exceeded ¼ gr. per lb., even after eighteen months' storage.

Mantell[14] predicts a future for containers entirely free from tin and consisting of sheet iron with an enamelled surface. A large number of tinless cans, it is stated, have been used for fish products, and the food has been preserved in a better condition than in ordinary cans.

The Estimation of Tin in Foods.

The procedure most generally employed consists of destruction of the organic matter by ashing or heating with sulphuric acid followed by precipitation of the tin as sulphide. Various processes have been proposed for the volumetric determination of the tin in solution.[15] In the Crosse and Blackwell laboratories the method of Clarke[16] applied to acid digestions of the food has given results in satisfactory agreement with those obtained by the longer and more tedious gravimetric method. In this method the tin is reduced to the stannous condition by means of lead, and the apparatus required, first suggested by Evans,[17] is simple and inexpensive. In carrying out a determination the food (usually 100 gm.) is treated with sulphuric acid 50 c.c. and sufficient nitric acid to destroy the organic matter in the usual way. The digest is diluted with about 100 c.c. of water and is boiled to remove excess of nitric acid. It is then transferred to a 750 c.c. conical flask with 50 c.c. of concentrated hydrochloric acid and sufficient water to give a volume of 250 c.c. This mixture is heated with lead foil in the presence of carbon dioxide, according to the method of Clarke, and finally the stannous salt is titrated with N/100 iodine. The presence of iron has not been found to interfere with the determination, but results are vitiated if copper or antimony be present.

The Pharmacology of Tin Compounds.

Tin compounds are little used in medicine. The powdered metal was formerly employed as a mechanical anthelminthic in doses of ½ oz., and the metal and tin oxide—dose 1 gm.—have been given for staphylococcic infections. Their utility has, however, been questioned, since tin compounds have *in vitro* only a weak action against bacteria, especially staphylococci.[18] The fatal dose of tin *per os* for dogs is given as 4 to 6 gm. of stannous chloride, death being due to corrosive irritant action on the stomach, cramp, and difficulty with respiration;[19] stannic chloride 0·9 gm. caused vomiting. Ogier[20] gives 4 to 8 gm. of the oxide as the fatal dose for dogs. Tin acetate, tartrate, and chloride 1 gm. every six days to rabbits caused death in about sixteen days, dissection showing inflammation of the stomach and degeneration of heart, kidneys, and liver.[21] The fatal dose for guinea-pigs was found to be much less than this.[22]

Early workers on the pharmacology of tin salts were White,[23] who found tin in the muscles, liver, and brain following intravenous injection, and Unger and Bodländer. The latter, quoted by Schryver[24] in his report on tin in canned foods, showed the presence of tin in the urine and fæces following subcutaneous injection. In animals the symptoms of chronic tin poisoning were irritation of the digestive tract and disturbances in the central nervous system and general nutrition. These symptoms could be produced in dogs, especially lameness, due to the effect on the central nervous system, by continued feeding with very large amounts of tin. Salant, Rieger, and Treuthardt[25] found that, following subcutaneous injection of the tartrate, the tin was chiefly eliminated by the gastro-intestinal tract, the kidney playing a subordinate though important rôle. This salt was also given by the mouth, and, in the case of rabbits fed for three to four days and dogs fed from two to four weeks, there was practically no absorption from the gastro-intestinal tract, traces only of tin being found in the urine. With prolonged feeding (during four months) of rats, however, absorption was observed. It was concluded that the continued feeding possibly caused changes in the mucosa of the gastro-intestinal tract favouring absorption of the metal.

Salant[26] has reported on the feeding of cats over long periods with tin as tartrate or chloride. With 10 mgm. daily per kilo body weight for twenty-three days and 20 mgm. for three months no harmful effects were observed, excretion being chiefly through the intestine. Further feeding during two and a half months of daily amounts of from 30 to 50 mgm. per kilo caused loss of weight. This is in fair agreement with the much earlier work of Lehmann mentioned by Schryver in his report. Lehmann in 1902 found no ill-effects to follow the feeding of cats with quantities up to 40 mgm. of tin daily. The absence of appreciable absorption from the intestine has been confirmed by the more recent work of Flinn and Inouye[27] in considering the question of metals taken up from cooking utensils. Feeding experiments chiefly with rats showed that with tin, copper, and nickel the amount excreted in the fæces was 98·5 to 99 per cent. of the amount ingested. The opinion was expressed that there was no evidence of chronic poisoning from utensils of the metals tested.

Conclusions based on animal tests need to be verified

by experiments on the human organism. Schryver (*loc. cit.*) carried out feeding tests on himself, taking 1 gr. of tin, as the tartrate, daily for a week, followed by 2 gr. the second week and 3 gr. during the third week. For the first two weeks there was no evidence of accumulation of tin in the body, but during the third week there was a retention of about 2 gr. of tin. The amount of tin excreted in the fæces averaged 94 per cent., but he pointed out the possibility of part of the tin being first absorbed from the alimentary tract and then re-excreted.

It has been shown that tin combines with proteins becoming insoluble, so that in canned foods it is usual to find the greater proportion of the metal in the solid contents. Bigelow[28] showed that the longer the food had been canned, the larger was the amount of insoluble tin. Results for the toxicity of tin based on the use of soluble salts could not, he considered, be used as a criterion of the toxicity of canned food containing tin in an insoluble form. Goss[29] arrived at similar conclusions. He showed that with proteins of low tin content a small amount resisted peptic or tryptic digestion, this residue containing nearly all the tin. With canned foods this interference would not appreciably affect the food value, but would mean that in all probability the tin-protein complexes would not be decomposed in the digestive process to exert toxic action. The possible complicating factor of bacterial action in the stomach and intestines is admitted.

Schwartze and Clarke[30] studied the effect of administering tin in the form in which it would occur in canned food. A diet containing 777 parts per million of tin (*a*) as tin corroded by pumpkin, (*b*) as stannous chloride, and (*c*) as stannic chloride, was given to guinea-pigs. The animals grew well in all cases and no abnormal conditions were found. Analysis showed no tin in the spleen, liver, or kidneys. With cats, no tin was found in these organs nor in portions of the skin, blood, and lungs following the ingestion of 1·2 and 2·2 gm. during three to seven months. Four men were fed on canned pumpkin and asparagus containing tin, receiving during five days 2 to 2·75 gm.—*i.e.*, 30 to 40 gr. Micro-chemical tests showed tin absent in twelve of sixteen urines, and in no case was more than 0·4 mgm. of tin oxide (impure) separated.

From the results of Lehmann and of Salant it appears that cats tolerate 20 mgm. of tin per kilo without loss of weight or the appearance of toxic symptoms. It is not possible to deduce accurately the dose for man from the corresponding dose for animals, but, using Meeh's formula, the above amount would be equivalent, roughly, to 5 gr. daily for a man. Calculated directly on body weight, the amount would be appreciably higher. The pharmacological data indicates, therefore, that amounts of tin exceeding that likely to be derived from foods should give no ill-effects and be largely unabsorbed from the intestine. There are indications that with prolonged ingestion there may be some absorption and retention in the body. The doses required to give serious acute poisoning symptoms would be expected to be very considerably greater than 5 gr. Some cases of poisoning ascribed to the ingestion of tin are given below.

Reported Cases of Tin Poisoning.

The symptoms of acute tin poisoning are stated to be metallic taste, vomiting, diarrhœa, and pain in the stomach. Pains in the head have been observed, and in some cases there is depression of the heart and difficulty with respiration. Cases of poisoning following the ingestion of food contaminated with tin are rare, and very few have occurred within recent years. Schryver gave an account of the earlier cases of alleged poisoning, but only in those of Kayser,[31] Luff,[32] and Günther[33] is there available quantitative data on the actual food consumed. Kayser reported poisoning following the consumption of preserved eels found to contain 0·19 per cent. of tin. In the case of Luff, four men had symptoms of irritant poisoning after eating a tin of meat and a tin of cherries. The source of the trouble was held to be the cherries, containing 1·5 gr. of tin per fluid ounce, and it was calculated that doses of from 1·8 to 4·7 gr. of tin were taken by the sufferers. With Günther a dose of 2·3 gr. of tin was considered to be the cause of violent poisoning symptoms. Dixon Mann[34] describes an instance of griping pains and nausea from tinned rhubarb containing tin oxalate equivalent to 2·7 gr. of tin per ounce. Poisoning has also been ascribed to the presence of tin in preserved asparagus,[35] and to the attack of a tin vessel by sour milk.[36]

The above examples form some evidence that symptoms of acute tin poisoning may be caused by amounts of tin which, in unusual circumstances, may be present in food products. In view of the greatly increased consumption of canned goods, it is extraordinary, however, that so few cases have been reported during recent years. It is possible that some of the earlier poisoning cases held to be due to tin may have actually been caused by bacterial trouble. Even in the absence of sufficiently large amounts of tin to cause acute symptoms there is the possibility that the continued taking of foodstuffs containing small quantities of tin may give rise to chronic poisoning. Very few cases of chronic tin poisoning have been recorded in the literature.

Pedley[37] has described the case of a man continually subjected to the fumes of stannic chloride in mixing this chemical with hydrochloric acid. He was of good physique, and nothing was found to account for symptoms including a feeling of chilliness and heaviness in the stomach and pain in the throat. Finally, tin poisoning was suspected, and minute amounts of this metal were found in the urine and fæces. In the earlier case of Jolles[38] a young woman suffering from nervous symptoms, anæmia, and emaciation became definitely worse on wearing some stockings which were subsequently found to be heavily impregnated with stannic chloride. Tin was found in the urine. In Salzer's[39] case somewhat similar symptoms to those described by Pedley were ascribed to the use of a dental plate, the matrix of which contained ⅝ tin and ⅜ bismuth. The excretion of tin was confirmed.

In his summary of tin poisoning Pedley concluded that, while it is not unreasonable with unusual symptoms associated with the excretion of an unusual metal in the

urine to assume poisoning by that metal, "in the case of tin it does not seem reasonable to attribute poisoning symptoms to it when only three cases of alleged chronic poisoning can be discovered in the literature." It is, however, remotely possible that the continued ingestion of tin may cause slight symptoms which would be difficult to diagnose correctly, even if they were sufficiently serious to warrant medical attention.

As a result of Schryver's work, Buchanan stated that the presence of tin in quantities approaching 2 gr. to the pound may be taken to signify that the food has become potentially deleterious to health. This quantity has come to be regarded as the maximum amount permissible in food, and some prosecutions—not always successful—have been instituted where this proportion has been exceeded. Buchanan's statement was made in 1908, and, in view of the considerable variety of canned foods obtainable and the probability that for many people they now regularly constitute a part of the diet, there does not appear to be any valid reason why this "limit" should be increased. The greater knowledge and experience in canning should make it possible—at all events with most products—to keep the tin content very much below this figure.

It might be expected that some individuals, especially children, would be very sensitive to minute amounts of tin, but no record of such cases could be found in the literature. This supports the pharmacological finding that, taken by the mouth, the metal is almost entirely unabsorbed from the intestine. With less than 2 gr. of tin per pound there appears to be practically no danger of acute poisoning. There remains the possibility that, taken over long periods of time, tin may be slightly absorbed to produce minor disturbances in health or aggravate a condition of ill-health. This can only be definitely eliminated by extensive feeding experiments with human beings, and the subject needs re-investigation from this aspect. At the present time the balance of evidence goes to show that no harm results from the consumption of minute amounts of tin in food. The considered opinion of Savage and White[40] in 1925 after their study of 100 recent outbreaks of food poisoning still holds: "Although special attention was paid to canned food outbreaks . . . we have not come across any instances of tin poisoning, and are unaware of any reports on tin poisoning from canned foods in recent years."

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MR. FRANCIS GREVILLE WILLIAMS

MR. FRANCIS GREVILLE WILLIAMS, who was one of the original founders of the firm Williams Bros. and Company, died on October 13, in his seventy-fifth year. Mr. Williams was a partner with his elder brother, Lewis Greville Williams, until the death of the latter in 1903, when he became manager until the formation of the present company, Williams (Hounslow) Ltd., in April, 1925, from which date he held the post of chairman of the directors until his death.

On starting at Hounslow, Messrs Williams Bros. and Company had a comparatively small factory, employing not more than twenty hands and manufacturing only about a dozen colours, from which small beginnings the present factory has been evolved, employing a large number of men and manufacturing considerably over one hundred colours. During all these years the deceased was closely identified with the activities of the firm and was greatly respected and liked not only by the staff and workmen, but by all those with whom he came in contact.

In his earlier days, Mr. Williams was a keen supporter of the volunteer movement, serving in the 2nd V.B. Royal Fusiliers, where he eventually rose to the rank of major. He leaves a widow but no family.

BANANA STORAGE

An account of investigations in the West Indies

A FURTHER step in the investigations into the storage and transport behaviour of certain varieties of West Indian bananas, now in progress at the Imperial College of Tropical Agriculture, Trinidad, is described in *Banana Storage*, by Dr. Wardlaw and Dr. McGuire, issued by the Empire Marketing Board. The West Indies grow an excellent variety of banana—the Gros Michel—which behaves admirably in storage and transport, arriving in the British fruiterers' shops in an attractive state of ripeness. It is, however, susceptible to Panama disease, a virulent fungal rot which devastates even the best situated and the best tended plantations. Other difficulties arise with this as with all crops, but Panama disease is by far the most formidable.

Research into the problems of the West Indian banana trade, carried on at Trinidad and at Kew over the last five years, with the financial help of the Empire Marketing Board, has followed three main lines. A special study has been made of the fungus which causes Panama disease and the conditions which favour it. An attempt is being made to breed a type of banana that will be immune to Panama disease. Thirdly, the behaviour of immune varieties in storage and transport is being studied with a view to discovering a variety which will reproduce the special qualifications for travel of the Gros Michel, and will succeed—where the Gros Michel fails—in escaping the ravages of Panama disease. The present report deals with a stage of the last of these three activities. Other branches of the work, which is still in progress, have been dealt with in reports by the same authors and by Dr. Cheesman, previously issued by the Empire Marketing Board.

During the recent investigations at the Trinidad Low Temperature Station, storage trials were undertaken with the following varieties of bananas: the Giant Governor; the Trinidad Governor or Cavendish variety; various Cavendish types; Fill Basket; Gros Michel; the College Hybrids I.C. 1 and I.C. 2; an assemblage of tall types including the Giant Fig; Lacatan; Bumulan; Martaban; and Mask Hijau.

The Giant Governor, believed to be a tall mutant of the Dwarf or Cavendish variety, has given promising results. When grown under the same conditions, this variety produces considerably larger bunches than the ordinary dwarf or Governor variety, while the cylindrical shape and symmetry of the bunch, and the relatively tough skin of individual fruits, render it much more suitable for naked bulk transport. So far the excessive injury to the top hands and scarring usually found on the ordinary Governor variety have not been observed. Fruit stored at 53° F. for 16 or more days developed chill effects, but at 58° F. normal ripening to an attractive deep yellow colour was the rule. A transport temperature commencing at 56° F. and rising to 58° F. would probably be suitable for this variety.

Bunches must be reaped at a stage corresponding to "heavy ¾—full" in the Gros Michel, otherwise ripening at 70° F. is greatly delayed, and abnormal colour effects, such as pastiness or russeting, develop. As a result, fruit for export tends to be heavy and the individual fingers of rather large size. Texture and flavour are good. Shipping trials under the usual commercial conditions must be the next step. Until the results of these are known final judgment on the value of this banana for export purposes must be held in abeyance.

A number of consignments of the Dwarf, Cavendish, or Governor variety were taken into storage and held at 53° F. with the object of finding out what influence soil and manurial treatment would have on the subsequent behaviour of the fruit in storage. Fruit for these experiments was obtained from the College Farm from a series of plots that had been treated with different kinds of manures. In the fruit from two plots, in the one instance treated with synthetic pen manure, and in the other with the same manure to which a proportion of potash had been added, there appeared to be no difference, either in rapidity of ripening or subsequent decay or in bruise resistance. In general it may be said that considering the initial unsuitability of this soil for banana growing the parent plants have shown an amazing response to

Packing Banana Slices in the West Indies.

(By courtesy of the West India Committee.)

manurial treatment as indicated by the development of the plant and size of bunch and fingers.

Almost without exception, and possibly owing to the rushed growth or the long rainy season, the fruit showed itself very subject to bruising. In the short journey to the Low Temperature Research Station some 60 to 80 per cent. of the bunches showed traces of mechanical damage. From the experiments just described it can only be concluded that fruit of this variety, grown with the help of fertilisers on relatively poor soils, is so subject to mechanical injury during transport that it is quite unsuitable for exporting as naked bulk consignments. Judged by their bunch habit, texture, colouring and flavour, dwarf Cavendish from different sources, British Guiana, Trinidad, Barbados, the Virgin Islands, and the Canary Islands, seem to be very closely related if not one and the same variety.

Fill Basket stored at 53° F. for 16 days subsequently ripened very attractively at 70°. In actual appearance these bananas were the most handsome type of banana (Gros Michel included) dealt with at the Low Temperature Station. The bunch habit and the thin skin would, however, preclude rough treatment. Nevertheless, it is thought that this banana, which on account of its dainty size and appearance is known as "Ladies' Fingers," might have considerable local commercial value during the tourist season.

In two bulk storage trials with the Gros Michel, wastage due to breaking of finger-stalks, scarring and bruising, was quite normal and comparable with that experienced in Jamaican or Central American fruit. Uneven ripening in bunches, where single fingers or entire hands were involved, was a characteristic feature of both trials. As this would be regarded as a serious defect by the trade, further investigations to determine whether it is cultural or seasonal are required.

In a preliminary storage trial with the new College Hybrid I.C. 2, it was found that this variety possesses characters common to the Gros Michel—namely, resistance to bruising and attractive yellow colour on ripening. The flesh is of good texture, and is regarded as being superior in flavour to the Hybrid I.C. 1. The bunches so far obtained—on relatively poor soil—have been small and the fingers short, thick, and closely packed. Further storage trials are required with well-developed bunches grown on good alluvial soil.

Bunches of Giant Fig, Lacatan, Bumulan, Martaban and Mask Hijau, of approximately the same age and obtained from the same or adjacent rows in the College variety plot, were stored and ripened under identical conditions. All showed very great similarity in the characters developed during ripening. This lends support to a view which has been expressed that these several tall forms are not separate and distinct varieties, but are, in fact, identical.

(*"Banana Storage," by Dr. C. W. Wardlaw and Dr. L. P. McGuire. H.M. Stationery Office, September, 1933. Price 1s. net.*)

MR. E. T. BREWIS

MR. EDWARD THEODORE BREWIS, F.I.C., chief analytical chemist to Stafford Allen and Sons, Ltd., of London and Long Melford, the well-known essential oil distillers, died on October 12, after a few days' illness at his home in Leytonstone.

Mr. Brewis joined Stafford Allen and Sons, Ltd., in 1894 as chief chemist, and subsequently played a pioneer part in the establishment of laboratories and up-to-date analytical equipment. His wide knowledge and practical experience have been invaluable in keeping his firm's processes and products abreast of the times.

It is with very great regret that we learn of his passing.

PRESSURE IN CANS

The following is a summary of a report by P. Chambellan, H. Cheftel, M. L. Thuillot, and R. Boudeau, entitled: "La pression intérieure dans les boîtes de conserves et ses variations pendant la stérilisation." The experimental work was carried out in the Forges de Basse-Indre Laboratoire de Recherches Biologiques.

WHEN A foodstuff is enclosed in a tinplated container which is then subjected to sterilisation in boiling water or an autoclave, it is well known that the internal pressure undergoes variations. Bottom bulging is one of the first consequences of these variations, but the shape returns to normal on cooling. When the internal pressure exceeds certain limits, however, obvious drawbacks are manifested. Thus, the seams are subjected to excessive strain, or permanent distortion of the bottom may ensue, which leads eventually to leaks. Cases are also known of excessive pressure and distortion preventing the base from returning to its normal position, so that the containers remain permanently buckled.

All these disagreeable features are well known to canners, and experts have long sought ways and means of overcoming them. Certain methods which have been worked out have now been adopted for factory conditions, while other methods are still in the research stage.

Regarding the theoretical aspect of the study of the internal pressure of containers, previous work has been limited to a superficial examination of the relevant factors, and practical conclusions have often been drawn in the absence of any exact recognition of the forces at work. The authors have essayed a detailed examination of the latter, involving their expression in exact mathematical form. They have developed a formula which is not unduly complicated and which enables a calculation to be made of the internal pressure of a container, provided the initial and final conditions are known. For example, the maximum internal pressure reached during sterilisation can be calculated if one knows the temperatures at which sterilisation and closing were effected and the shape of the container. It is thus possible to predict whether a given container will stand up to such conditions or whether it will burst or develop leaks.

A comparison of the theoretical results with those obtained in actual practice revealed that these agreed to within 50 gm. pressure. As the measurements are of the order of 1,000 gm. or more, this represents an error of less than 5 per cent., a highly satisfactory result when it is remembered that the variations in pressure arising from differences between one tin and another are of the same order.

Two facts of great general interest were revealed by the experimental work:

1. *At the usual sterilisation a variation of* 1° *C. corresponds to a difference of internal pressure of about* 50 *gm.* This shows how necessary it is to regulate the temperature of the retort accurately. Thus, if sterilisation is carried out at 116° C., the initial internal pressure would be 1 kilo 700 gm. Although the metal withstands this strain, it comes dangerously near the limit of resistance. If, therefore, the autoclave temperature is inadvertently allowed to rise to 120° C., the internal pressure will rise correspondingly to 1 kilo 900 gm. This exceeds the limit of resistance, and the batch will consequently show a high percentage of buckled seams and leaks. This danger would have been entirely obviated if the apparatus had been equipped with a regulator.

2. The pressure and temperature indicated by a metallic manometer are dependent upon the temperature of the instrument itself. A cold current of air may cause a reduction in the reading of 20 gm. or more; conversely, if exposed to a steam jet, the instrument will erroneously record an increase. Even under laboratory conditions, considerable difficulty is experienced in securing exact pressure readings with the aid of metallic manometers. Use was made in the present connection of a special instrument. In the manufacture of preserves, sterilisation is undoubtedly the most important operation, the cornerstone of the entire structure. Exact knowledge of the autoclave temperature is of the highest importance—*and the manometer is not an instrument in which any confidence can be placed. What is really required is a mercury thermometer.*

After developing a formula which showed a satisfactory agreement between theoretical and practical results, several practical tests were carried out with a view to assessing the influence of various factors.

Below are summarised the results obtained in this connection:

1. BOTTOM DISTORTION.—Up to the year 1847 the bottoms of cans were flat-shaped, and made no allowance for possible increase in volume under the influence of pressure. Expansion of a gas or steam leads to diminution in pressure, but, owing to the impossibility of ex-

pansion in flat-bottomed tins, enormous pressures developed in the interior. A 4/4 (L 6) tin filled completely with cold water invariably burst at 115° C. Even partially filled tins recorded pressures of the order of 3 kilo. Records of the early canning firms reveal disastrous losses. Under the same conditions the pressure in the present-day 4/4 tin, with its nicely curved expansible bottom, hardly reaches 1 kilo 600 gm. It will thus be easily realised what the industry owes to the invention of Allen Taylor.

2. COMPARISON OF 4/4 (L 6) AND 2/1 (L 7) TINS.—The same calculations applied to a 2/1 tin with a 100 mm. base showed that in the case of non-expansible bottoms, the internal pressure would exceed 28 kilo as compared with a figure of 2 kilo in the case of the modern tin. These figures show at once why faults occur so much more frequently with 2/1 tins than with 4/4 tins.

One obvious reason for this difference is contained in the fact that in the case of the 4/4 tin the possible inincrease in volume represents 6 per cent. of the total volume, whereas with the 2 litre tin with a 100 mm. base the possible increase is only of the order of 3 per cent. This, of course, assumes that the bases occupy the same area and that the volume is twice as great in the second case.

Another reason is to be found in the relationship between height and volume. Calculations with reference to a given bottom diameter show that when a certain maximum height is exceeded, the containers develop a peculiar "sensitiveness." Very high pressures are then recorded even under normal working conditions. *The 4/4 (L 6) tin is below this critical limit, but the 2/1 (L 7) tin definitely exceeds it; that is why the L 7 tin as well as all the "fluted" shapes must be adjudged irrational.*

A curious fact which is already known to some extent empirically is that no danger is involved in completely filling the 4/4 tin, whereas ample free space must be left in the 2/1 tin. In the case of an initial temperature of 10° C. and a free space of 300 c.c., the pressure at 110° C. will be 1 kilo 750 gm. for the 4/4 (L 6) tin and 1 kilo 900 gm. for the 2/1 (L 7) tin. Reduction in the free space leads, however, to a final pressure of 1 kilo 600 gm. in the 4/4 tin, while that of the 2/1 tin rapidly increases and reaches 3 kilo in the completely filled tin.

3. CLOSING AT A HIGH TEMPERATURE.—The adoption of the expansible bottom invented by Allen Taylor therefore represented a great step forward in the canning industry. *A high temperature closure was the next landmark in the campaign to achieve maximum security.*

Calculation shows that the internal pressure of a 4/4 tin at 110° C. is 1 kilo 600 gm. when seamed at 10° C., and 1 kilo 250 gm. if the tin is seamed at 60° C. *Closing at a high temperature thus diminishes the pressure by 350gm.*, which represents a great reduction in the strain on the seams, so that the technique has been widely adopted in the United States and Great Britain, and will undoubtedly achieve recognition in the very near future in Europe. A reduction of several hundred gm. in the internal pressure is an extremely valuable achievement, since the limit of resistance of the bottom and seams is in the vicinity of 1 kilo 800 gm. Furthermore, the pressures developed in the interior during sterilisation are of the same order when the tin is seamed cold.

It will naturally be asked whether it is not possible to solve the problem from another direction—*i.e.*, by increasing the thickness of the tinplate and the resistance of the containers. To this it will suffice to rejoin that the results would not compensate for the technical difficulties which would require to be surmounted. Seaming could only then be effected with difficulty and the advantages of expanding bottoms would be lost.

Reverting to the calculation for high-temperature closing, it will be seen that *a 4/4 container seamed at 60° C. will register a partial vacuum of about 400 gm. after complete cooling.* This vacuum draws the bottom towards the interior and satisfactorily maintains it in that position in all climates. High-temperature closing presents two more very important advantages consequent upon elimination of the large volume of air occupying the free space. Corrosion due to acids, which occasions much trouble with fruits, is considerably reduced in the absence of atmospheric oxygen. Again, the vitamins, which are generally more sensitive to oxidation than to heat, are preserved uninjured. There can be no doubt at the present day that a well-prepared product is at least equal from this point of view to a freshly cooked product.

High-temperature closing can be effected either by the "steam-jet" method (when the ratio between solid products and juice allows of the attainment in this manner of an average temperature exceeding 60° C.) or by preheating, a procedure which involves passing the filled but unseamed tin through a steam or hot water bath.

4. COOLING UNDER PRESSURE.—A further advance of a very important character in the treatment of canned goods is represented by pressure cooling. The internal pressure of a tin in the retort is partly compensated by the pressure of the retort itself. At 110° C., for example, with an internal pressure in the tin of 1 kilo 700 gm., the effective pressure to which the base is exposed is only 1 kilo 200 gm., since 500 gm. are cancelled by the retort pressure. On suddenly opening the valve and rapidly releasing the retort pressure, the tin—which is still very warm—will be under an internal pressure of about 1 kilo 700 gm. But since no external pressure is available for compensation at this juncture, *the moment at which the pressure is released is a highly critical one.*

When cooling under pressure, the tin is cooled while maintaining a compensating external pressure, transference to the open air only being effected when the temperature and internal pressure have dropped to a point at which no further danger exists. Apart from the mechanical advantages, rapid cooling under pressure avoids overcooking and facilitates handling of the containers when being removed from the retort. The method is extensively used in France.

In the absence of the principle of pressure-cooling, it would have been impossible to utilise the modern type of continuous retort from which containers are removed at the rate of 100 to 150 per minute.

TRADE NOTES

A New Grinding Unit.

A new and interesting machine for grinding a great variety of material, including food products, is the Mikro-Pulveriser of Messrs. Bramigk and Company, Ltd.

Two of the chief advantages of this machine are that it is absolutely dustless in action and, owing to the low horse-power required, surprisingly inexpensive to run. Fuller particulars may be had from Messrs. Bramigk. Free demonstrations may also be arranged.

* * *

We are informed that Prior Burners, Ltd., have opened a service and sales depôt for Prior Mastokers at 58, Cromwell Street, Glasgow, N.W., to handle their increasing Scottish business.

The depôt will be in the charge of Mr. R. Clifford Primrose, F.I.M.T., who has represented the company in Glasgow for some time past. Enquiries regarding service and sales in Scotland should now be addressed to the Glasgow office, but technical details will continue to be dealt with in London.

* * *

Metal Plate and Sheet Work.

An interesting illustrated booklet on *Metal Plate and Sheet Work* has been received from the well-known specialists, Fredk. Braby and Co., Ltd. The various items listed and illustrated are far too numerous for individual mention, but they embrace a very wide field of food plant and machinery.

Readers interested would do well to obtain a copy of this booklet from Messrs. Fredk. Braby and Co., Ltd.

* * *

Power House Failures.

The total power and value of electrical equipment in canning and other food factories has grown enormously during the past twenty years. The heavy duty performance in up-to-date works employing filter presses, vacuum driers, pulpers, and bottling machines has demanded electric motor drives of higher and higher power and the use of more motors than ever before.

Increased mechanisation and the use of large output sifters, mixers, churns, exhausters, washers, conveyors, and the lighter accessory machines such as paste mills, labellers, crown cork closers and seamers has made essential the testing and maintenance of every part of the electrical plant in first-class condition.

Even in an average size works this is no small task when it is carried out regularly and thoroughly—that is to say, to a programme and not after a breakdown. Testing of "insulation worthiness" must be a routine task calling for properly logged results.

Avoiding Breakdowns.

An important addition, therefore, to the food manufacturer's shelves of handy reference works is the pocket-book *How to Avoid Electrical Breakdown*. This is published by a pioneer firm of electrical instrument makers who have recently produced the first pocket size insulation tester.

A foreword states that systematic measurement of insulation, which can be carried out with the help of a Megger Insulation Tester, shows whether the insulation or apparatus is healthy, and helps those responsible to maintain it in a satisfactory condition and so avoid interruptions or breakdowns.

The pocket-book gives simple instructions for carrying out tests and for recording the results in a log-book. This permanent record is valuable to the maintenance engineer, for it enables him to prove that the plant under his charge is being maintained in a safe condition, or to indicate if repairs are necessary.

* * *

Insulation and Atmosphere.

The moisture unavoidable in certain departments of works devoted to food preparation causes rapid breakdown of dielectric strength. The absorption of moisture lowers the resistance of the insulator, while an accumulation of dirt upon the surface of it, though it does not theoretically alter the insulation resistance, provides a conducting path through the dirt.

The effect of moisture on insulating material is shown in the table below:

Time.	*Insulation Resistance.*
On placing in drier	1,000 ohms
After ½ hour ...	1·1 megohms
,, 1 ,, ...	6·0 ,,
,, 1½ hours ...	15·0 ,,
,, 2 ,, ...	26·0 ,,
,, 3 ,, ...	36·0 ,,
,, 4 ,, ...	40·0 ,,

Here a piece of apparatus was placed in a vacuum oven to dry, the insulation resistance measuring only 1,000 ohms when the drying operation commenced. The figures show how the insulation rose as the moisture was driven out, the figure after four hours being no less than 40 megohms. The importance of regular testing, therefore, cannot be over-emphasised.

The booklet from which this information has been taken may be obtained on application to Messrs. Evershed and Vignoles, Ltd.

* * *

Cod Liver Oil Emulsions.

The following is the corrected version of a recipe which appeared in the October Information and Advice columns:

B.P.C.

With Glycerophosphates.

Cod liver oil	50·00
Calcium glycerophos.	0·91
Iron glycerophos. in scales ...	0·45
Mag. glycerophos.	0·45
Pot. glycerophos.	0·45
Sodium glycerophos.	0·45
Glycerophosphoric acid 20 per cent.	1·04
Yolk of egg (vol.)	7·50
Tragacanth powder	0·25
Elixir of gluside	1·04
Tinct. of benzoin	1·04
Spirits of chloroform	3·14
Bitter almond oil (*sine* HCN)	0·10
Aqua dest. ad	100·00

Slitting and Rubbing Cinnamon Bark, Ceylon.

(By courtesy of Stafford Allen and Sons Ltd.)

INFORMATION and ADVICE

MALEIC ACID—PACKING SUET—SOUP PASTE—CATECHU—LACTOSE—ALUMINIUM—PEANUT ROASTING—CONCENTRATED APPLE JUICE—PEELING OF GRAPES—OIL FOR FISH CANNING—CLOUDINESS IN HONEY—ARTIFICIAL CASINGS—MINCEMEAT—ANGELICA—SAUCE THICKENING—WALNUT SHELLING—VISCOSITY DETERMINATIONS—RECIPES—OATMEAL BREAD—RANCIDITY INHIBITORS—EGG STORAGE

Maleic Acid.

1,468. *We have been reading with interest your comments on the subject of Rancidity, and particularly wish to refer to the article in the June issue on pages 183 and 184 on this important subject.*

We would like further information on the product maleic acid which you refer to as a cheap and easily produced synthetic compound, and would be obliged if you could give our name and address to manufacturers of this acid, asking them to quote us and at the same time send out a small sample as we feel sure that this acid will be of interest in our manufacture.

We have so far not been able to obtain any information here in Australia. (Australia.)

This acid may be produced (*a*) from malic acid by distillation, (*b*) by heating the acetyl derivative of malic acid, (*c*) by the catalytic oxidation of benzene. It is used in the textile industry in the dyeing and finishing of cotton, wool, and silk.

We shall be glad to hear from firms able to supply this substance.

Packing Suet.

1,469. *We should be very grateful if you would kindly give us your advice with regard to the following queries:*

(a) *In the seaming of tins for suet, dripping, and margarine should the tins be seamed when the product is hot or cold?*

(b) *Technically speaking, when is a tin considered to be hermetically sealed?*

(c) *Is it necessary or even required or recommended in the seaming of suet, dripping, and margarine, that it should be done under a vacuum?*

(d) *If there is a small space left at the top of the tin after seaming will this affect the suet, dripping, or margarine, if seamed hot or cold?* (London.)

Without knowing further particulars about the character of the product which you intend to pack, particularly in the case of margarine, it is difficult to give you any precise information. Suet and dripping are run into the cans in a hot condition.

The cans are seamed almost immediately after running in while the product is hot.

In the case of margarine, much depends on the water content and the purpose for which the margarine is to be used. To melt the margarine destroys its special qualities depending on its structure in which water plays a part. With a very low content in water the margarine may be melted and treated as suet or dripping, but with a good quality margarine containing water it would have to be filled cold into the cans and afterwards lidded. There are machines made for this purpose.

These machines are primarily used for packing butter into cans. The butter is automatically weighed out in amounts taken by each can and is shaped into a cylinder of a diameter about $\frac{1}{8}$ inch less than that of the can. This is inserted in the can and pressed down by a wooden plunger so as to fill the can completely. The lid is then double-seamed into position.

The word hermetic refers to an air-tight closure.

Soup Paste.

1,470. *Can you tell us also whether soup paste can be filled into the containers cold and sealed in the usual way—i.e., not under a vacuum—without risk of fermentation or any bacterial action setting up sometime afterwards, and would the jars have to be sterilised and how would this be done?* (London.)

We would not like to venture an opinion on this without knowing something about the composition of the paste and also about its preparation. The only safe way is to run a bacteriological test. If the material filled cold does not withstand spoilage, it will be a simple matter to sterilise on the lines adopted for meat pastes.

Catechu.

1,471. *Will you kindly let us have some information on catechu?* (London.)

There are two varieties—pale catechu and black catechu. The former appears to be most generally used and is stated to be prepared in Singapore and other places in the East. This pale catechu is an extract of the leaf and young shoots of *Uncaria gambier*. The black catechu is an extract from the wood of *Acacia catechu*. The following are the characteristics given of pale catechu.

In cubes (some agglutinated) each side 25 millimetres, deep reddish-brown externally, pale brown internally; dull earthy fracture, under the microscope showing myriads of small acicular crystals. Odourless. Taste at first astringent, bitter, then sweet. Entirely soluble in boiling water.

Catechu is a powerful astringent, acting by virtue of its tannic acid, and having a precisely similar action to it. It is used as a lozenge for sore throats, and the other preparations, especially the compound powder, are very efficacious for diarrhœa.

As the catechu is soluble in boiling water it is quite a simple operation to effect extraction from the leaves and shoots of the plant. This would mean a machine for chopping and then the ordinary percolators used for extraction purposes, or it may be simply extracted by boiling the chopped-up leaves and shoots in water and then filtering.

Lactose.

1,472. *I would be much obliged if you would give me any indication of the market possibilities, if any, of lactose, and what is the current price.* (British Isles.)

There is a steady demand for lactose, the current price being 57s. 6d. per cwt., for small quantities (5 to 20 cwt.), with little fluctuation in price. It is used for the manufacture of infant foods, confectionery, and, to a small extent, breadmaking. No information is available as to the distribution of sales of lactose among the various manufacturing

trades. This is also complicated by the fact that the manufacturers of various special lines on a large scale provide their own supply of lactose.

The so-called humanised milks (which have largely replaced dried whole milks as infants' foods) are prepared from whole milk, fat-whey, or cream and whey, together with added lactose and cream.

Lactose is a valuable food material, especially useful when the stomach is irritable. The enzyme lactose of the intestinal juice converts lactose into equal parts of glucose and galactose. Lactose is not fermented, as are the monosaccharides, by the zymase of yeast.

Lactose is sometimes added by dispensers with the object of stiffening a soft mass in pill-making.

Aluminium.

1,473. *Required, references in technical literature to the effect of using aluminium utensils and machinery in the manufacture of foodstuffs and also the effect of aluminium absorbed in small amounts into the human body.* (London.)

Examples of this literature are:

The Danger of Food Contamination by Aluminium, by Dr. R. M. Le Hunte Cooper.

The Clinical Aspect of Chronic Poisoning by Aluminium and its Alloys, by Dr. L. Spira.

Aluminium and Food, by J. H. Burn, M.A., M.D. This is issued by the Council of the British Non-Ferrous Metals Research Association.

The "Lancet" Reports on Aluminium Ware. Issued by the British Aluminium Co., Ltd.

Peanut Roasting.

1,474. *Can you give us some information on the roasting of peanuts?*

Very careful control temperature has to be exercised. The roasting temperature is about 320° F., requiring 30 to 40 minutes to complete the operation.

Too high a temperature is liable to scorch the nuts and to impart a burnt taste. On the other hand, too low a temperature results in a raw taste. The finishing point has to be judged by noting the colour and texture, and the ease with which the skins can be removed.

Instead of the usual coffee type of roaster, roasting is sometimes done in hydrogenated peanut oil or low melting point coconut stearin at, say, 350° F. for 50 minutes. Dipping may also be done in fat, such as coconut stearine, which would not be soaked up to the extent you mention.

As to the amounts required, we are not able to give these, but, of course, they can easily be determined by carrying out a test.

Concentrated Apple Juice.

1,475. *May I once more ask for your assistance in order to obtain some information on concentrated cider must?*

I have noticed in the January number of your paper an article regarding imports into Great Britain of cider in concentrated form.

I have therefore thought it possible that you might also, at some time or other, have published particulars on concentrated cider must.

I am very desirous to know whether there is a trade in Great Britain for this product, and whether it has already been imported there. (France.)

With reference to concentrated apple juice. During recent years a certain quantity of this product has been exported from European countries such as Switzerland, France, and Germany, but the main bulk undoubtedly comes from Canada. The French concentrated juice will possess a high tannin content, while German and Swiss types will be on the sharp side. We think it is safe to say that by far the best concentrate ever sold is that marketed as "Pomol" by Tobler's in Switzerland; this is produced by a patented process and is capable of yielding a high-class cider.

The Canadian concentrate is made almost exclusively from culinary and dessert fruits, and consequently is not quite so satisfactory for cider making. But such is the demand for cider, and such is the shortage of fruit here, that Canadian concentrate has been selling very largely in the West of England and large volumes of cider have been produced therefrom.

Until recently the Canadians have used the open-pan boiling method, which has resulted in a very dark concentrate with an unmistakable and unforgivable "cooked" flavour. But the last year or two has seen the introduction of the vacuum glass-lined tank, and a much better product is being marketed. The Canadians can afford to sell the concentrate at a very cheap rate, for the fruit used in its production is of no other use. Three years ago, Nova Scotia was ravaged by violent gales, and the enormous amounts of windfalls were all concentrated down and sold over here.

The usual concentration for such products is 1·280 specific gravity, equal to about 32° Beaumé. This is the lowest possible degree of concentration allowable, on account of the possibility of fermentation in less sugary products.

In Italy, fruit juices are concentrated by a combined freezing and heating process. The juice is frozen and then separated by a centrifuge, the final concentration being effected by vacuum heating. The cost of freezing precludes this being a commercial proposition in this country at the present time.

Peeling of Grapes.

1,476. *We have received the following enquiry from some friends of ours in Spain who intend to pack grapes in tins, and they would like to know if you could advise them as to the best method of peeling Almeria grapes.*

As you know, the peel of this kind of grape is hard, and it is easier to peel by hand than the average red or softer grapes.

They would like also to know if there is any machinery made in England for stoning these grapes. (London.)

Probably the best way of doing this is to employ the lye-boiling process, as employed for the peeling of peaches.

In this case the immersion in the lye varies from 20 to 120 seconds. The ripeness of the fruit determines the strength of the solution required and the time of the immersion.

The lye solution should be boiling, because uniformity and speed of peeling are facilitated by increased temperature. It is desirable also to immerse the fruit in boiling water.

After the lye treatment the fruit is thoroughly washed in water; first of all hot water and then cold running water.

For the preparation of the lye solution itself, granular or flake sodium hydroxide is used.

In the peach canning districts of California special mechanical equipment is used for carrying out this lye-peeling operation.

The names of suppliers of this equipment and also of stoning machines were supplied.

Oil for Fish Canning.

1,477. *We write to ask whether you can give us any information concerning the canning of fish in pharmaceutical mineral oil. The points that are of immediate interest are:*

1. *Whether this can be successfully accomplished.*
2. *Whether there would be any legal difficulty in selling the fish so canned, having regard to the Food and Drugs Act.* (London.)

Our personal opinion of the matter is that you would be safe so long as you stated on the label the type of oil in which the sardines were packed, otherwise there is the chance of the authorities coming down on you on the score that the fish and oil were not of the "quality, nature, and substance demanded."

From the public opinion point of view, we do not think that mineral oil could come up to olive oil in flavour, colour, price, and food value. In fact, mineral oil has absolutely no food value.

There would be no particular difficulties on the processing side.

Cloudiness in Honey.

1,478. *Have you any information regarding the bottling of ordinary honey? When it is heated and strained through muslin it still leaves a sort of white scum on the top.* (London.)

With regard to your letter in which you say that one of your customers obtains a white scum on the top of honey which has been heated, there ought to be no trouble in curing this, as whenever honey is heated a scum of air bubbles is formed. All that is necessary is to let the honey stand in a tall tank provided with a tap at the bottom, and then draw off the clear honey into the containers.

Some of the more viscose honey always appears cloudy owing to the presence of minute air bubbles. In some packing stations, vacuum settling tanks are used to facilitate the removal of air bubbles. A honey of normal viscosity will usually clear in about 24 hours.

It would seem that the only other possibility is the presence of fine particles of wax, but it would be easy to determine whether the trouble is due to air bubbles or wax.

Artificial Casings.

1,479. *Can you give me some information on the handling of luncheon sausage in artificial skins? How is a glossy surface kept after cooking and how is bursting prevented? What temperature do you recommend?* (Scotland.)

The handling of luncheon sausages in artificial casings can be conducted along the same lines as those appertaining to natural casings, with the exception, however, that the former should never be punctured.

A glossy surface can usually be assured by wiping the surface clean of all foreign substances accumulating during processing and by storing the sausage in cellars not lower in temperature than 50° F. Colder temperatures will cause the sausage to " fade out," but the colour will revive as soon as the sausage is again placed in warmer temperatures.

To prevent bursting, excessive temperatures or rapid changes in temperature should be avoided at all times. Special care should be exercised so that the sausage is chilled thoroughly immediately after being taken from the cooking vats. For cooking, a temperature of 160° is recommended. If this temperature is maintained for a sufficient period it will ensure absolute permeation and it is sufficiently high to retard bacteriological reaction to the extent usually desired in sausage products.

Mincemeat.

1,480. *Will you please favour us with your opinion of the enclosed recipe for mincemeat?*

The complaint which has led to this formula being submitted to us is that there is difficulty with fermentation, and as we have informed our customer that by virtue of the Preservative Regulations it is forbidden to add any chemical preservative to mincemeat, we are anxious to advise them as to how best this formula might be modified to reduce the risk of spoilage through fermentation. (London.)

The recipe which you quote is almost identical with one of ours in regard to the proportions of your client's ingredients mentioned in his formula. Our formula, however, has a little more spice (which will help to preserve), and, in addition, has a little less than ½ of a pint of rum, 1 fluid ounce of 33 per cent. acetic acid, and a little over 1 pint of glycerine—these amounts being roughly adjusted to your client's formula. These additional ingredients will, of course, act as preservatives. Spirits of wine and rum flavouring could be used instead of rum.

Much depends on the method of preparation. One such method is as follows:

Chop the apples and drain on a table overnight, covering over with a cloth.

Next morning rub two-thirds of the glycerin over the cleaned and dried fruits. Then place the dried fruits (glycerined) in a trough and add the apples, suet (best rubbed with a little of the salt), and sugar (the latter through a sieve), followed by the salt and spices, also through a fine sieve. Mix well together. Over the mixture sprinkle the acetic acid and mix again.

Now add the tartaric acid through a fine sieve and mix. Then sprinkle on the rum which has been previously shaken with the oil of cassia. Mix well. Wipe the necks of the jars with a dry cloth which has been dipped in glycerin. Fill them up with the mincemeat and cover with paper circles that have been treated with glycerin. Tie over with dry parchment.

Of course, the above method involves the use of glycerin, which some people object to, on the ground that it should not be necessary for the avoidance of spoilage if perfect hygiene is observed. Another point is that a common cause of spoilage is from the apples. These should be prepared beforehand by putting them down in SO_2.

The following is one method of doing this:

Only clean, sterile casks in good condition should be used for packing. Remove the head from the cask and fill with good, sour cooking apples. Add 2 fluid oz. of a 5 per cent. solution of SO_2 to each gallon of cask capacity and head up. Fill with water and give the cask a roll to effect mixing. Store away under cover.

For use in making mincemeat, peel, core, and chop the apples. Boil gently. Drain and add to the thick sugar syrup in the steam-pan and bring to the boil. Place the dried fruit in a mixing tray and add the apple and syrup. When quite cold mix in the suet.

Angelica.

1,481. *Kindly inform me where angelica is grown—kind of soil, climate, amount of water, etc.* (England.)

Angelica requires a good, rich, slightly humid, and deep soil. The seed is sown in spring or summer in nursery beds, and the plants are planted out permanently in autumn and will commence to yield in the following year (provided they are well grown), when the leaves may be cut. In the third year, at the farthest, the plants run to seed; in this year both stems and leaves are cut, and the plantation is destroyed.

Sauce Thickening.

1,482. *Have you any information on a substitute for flour for thickening purposes in sauce manufacture?* (England.)

Sago or rice flour or a mixture of the two appear to be better than wheat flour. Still better is gum tragacanth, using about 6 lb. to a total of 48 gal. of 16 grain vinegar. Soak the gum in one-quarter of the vinegar for 24 hours. Add this through a sieve to the rest of the vinegar, followed by the sugar, salt, shallots, and spices. Gently bring to the boil and simmer for 15 minutes.

It is possible to use carageen or carob gum as a thickening agent.

Passing the sauce through a flat stone mill helps to prevent separation.

Walnut Shelling.

1,483. *We are wondering whether you can be of any assistance to us in regard to shelling walnuts. We find that in cracking the walnuts so many of the kernels are broken, and we are quite sure that they must be processed in some way first, either by making the shell swell or the kernel contract so that the kernel falls away from the shell without difficulty. We are hoping that there may be some harmless chemical which will do this, otherwise we are considering the possibility of doing the shelling by vacuum.*

We hope you do not mind our asking such information of you, but we feel that with your unlimited knowledge you may be able to help us. (London.)

In spite of your flattery, we are only too conscious of the fact that knowledge is, fortunately or unfortunately, without any limits, and this happens to be a case in point.

In America, where walnut shelling is carried out on a large scale, all walnuts are dried previous to being shelled. This drying has the effect of eliminating moisture from the nuts and so leaving a space between the shell and kernel, thus greatly facilitating shelling.

Walnuts are dried in a current of briskly circulating air at a temperature of 100° to 110° F. Details of types of driers used, etc., are to be found in the Oregon Agric. Coll. Exp. Sta. Bulletin No. 227, entitled, "Walnut Drying and Packing in Oregon," by Ernest H. Wiegand.

The authority on walnuts in this country is J. Hamond, of the East Malling Research Station, Kent.

Viscosity Determinations.

1,484. *Could you suggest any ways of determining the viscosity of gum tragacanth?* (London.)

Any firm of scientific instrument makers would be able to supply a suitable instrument. Personally, we would favour the falling sphere type (*e.g.*, the Nobel method), largely used for determining the viscosity of nitro-cellulose solutions. This method depends on the rate of fall of a steel ball in a graduated glass tube in which the solution is placed. There are various forms of apparatus employed.

Among other viscometers is that of British Standard Specification No. 188, 1929, which is a form of Ostwald's viscometer. Also, Sir Boverton Redwood's viscometer, which depends on the rate of flow of a definite volume of liquid through an agate jet—the simplest form of this is a wide glass tube with an orifice at the bottom. Again, there is the Michell viscometer for oils, gelatine, etc., as well as others, particulars of which may be obtained from any supplier of laboratory apparatus.

Recipes.

1,485. *Could you oblige us with recipes for lemon curd and coffee extract?* (London.)

We refer you to an article published in the July, 1932, issue. In the October issue, under Enquiry No. 1,461, an example of a recipe was given. These recipes for liquid coffee or coffee extract, as well as the methods of preparation, vary considerably according to the quality desired to market, the extent of output, and the capital outlay at one's disposal.

As regards lemon curd, we have published various articles and recipes—for example, in the May, 1931, issue. Success depends largely on experience in manipulation and not on the recipe alone, which it is a fairly simple matter to build up once the principles have been grasped, backed up by a willingness to run a series of trials and thus gain experience. If flour (say, maize and wheat) is used, this should be made into a paste with cold water and allowed to stand overnight. The sugar and glucose (say, 5 : 1 by weight) are boiled with water to 245° F. After cutting off steam, the flour paste is stirred in, followed by the lemon juice, eggs, and margarine. Gently bring to boiling point and then add any essences and colouring matter and simmer for 15 minutes.

Oatmeal Bread.

1,486. *Have you any information on the method of making oatmeal bread?*

This is a type of bread which up to the present has not been used in this country. However, there should be no special difficulty in making such a bread with the aid of gluten flour to supply the deficiency. Your best plan is to get some baking institute to carry out experiments.

Rancidity Inhibitors.

1,487. *We would like to enquire whether you are in a position to give us some details as regards inhibitors for animal and vegetable oils and fats. These oils and fats, as you know, are subject to oxidation, and there are now certain chemicals available (called inhibitors) which prevent this oxidation process.* (New York.)

Anti-oxygens, anti-oxidants, or inhibitors are usually easily oxidisable compounds which are capable of utilising any oxygen which might be activated on contact with the fat. Examples are lecithin, phenols, and some aromatic amines. The inhibitors are oxidised first, a process which delays the ultimate oxidation of the fat. The effect of the inhibition of the fat is, in time, overcome and the fats later oxidise as if no inhibitor were present.

In addition to this there is maleic acid, which Dr. Greenbak, of the U.S. Department of Agriculture, has worked upon. He has found that maleic acid is an extremely efficient inhibitor, and we would suggest that you get in touch with him on this point. Of course, on the other side of the question, you are acquainted with the fact that metals are powerful promoters of rancidity, as also the presence of oxygen, and conditions of high temperature and exposure of light. On the other hand, according to M. R. Coe, of Washington, U.S.A., who has taken out a patent on the subject, fats are preserved from rancidity by exclusion of light, except that having a certain wave-length range—*i.e.*, 4,900 to 5,600 Ångstrom units. This leads to the wrapping of fatty foodstuffs in special green transparent paper.

Egg Storage.

1,488. *Provided that a few hundred eggs were cracked and not used up in manufacture within 24 hours, what would be the extent of deterioration and the loss of keeping properties? Also, under the circumstances, would it be advisable to freeze the liquid, and, if so, would there be any loss of food value? Again, what temperatures are required for freezing?* (Midlands.)

These questions can only be answered in a general and theoretical way in absence of full details of your particular circumstances.

As you know, eggs, especially when broken, are extremely susceptible to infection by bacteria and moulds, and also changes of a chemical nature are brought about by the action of enzymes.

It would be very difficult to eliminate entirely the infection or to prevent altogether changes taking place in a batch of broken eggs which were exposed to the air. This would entail, in the first place, keeping the eggs away from any source of contamination. In fact, the air in the storage chamber would have to be sterilised, as would also the container; and, moreover, during the breaking of the eggs previous to storage there would have to be no opportunity for infection, which would in practice be a very difficult matter.

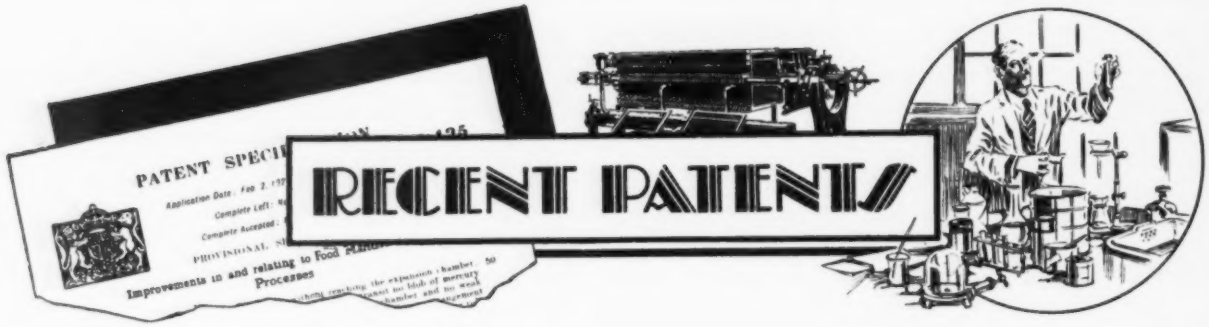
Again, the humidity and temperature of the storage chamber would have to be adjusted to the most suitable points. Everything, of course, depends on what the eggs are going to be used for and the degree of spoilage or other changes permitted in the material.

If the object is to cut down these changes to the absolute minimum, then you would be up against a difficult proposition. It is, of course, a simpler matter to store the eggs unchanged for a short period if they are still in the shell. This is a matter of everyday practice; but even in this case care has to be taken to see that the air in the storage chamber is free from contamination, such as bacteria and moulds, and even free from odours.

The temperature of cold rooms is usually about 45° F. in this country, while in America it may be a little lower—namely, 40° F. Also, the humidity of the air in these cold storers has to be controlled between 65 and 75 per cent. Excessive humidity, as you know, encourages the development of mould, and causes a serious deterioration of quality.

One has to guard against the possibility of one or more eggs decomposing and so ruining the whole batch. Another point that enters is the question of circulation of air; this is assuming that you start with a perfectly fresh batch. Even in the case of eggs in the shell you still have to reckon with the fact of instability in composition and the porosity of the shell, which offers no reliable protection against external influences.

As regards the question of freezing egg pulp into solid condition, this, of course, is common practice, but in your case seems unnecessary, if it is required to keep the eggs only a day or so. Egg pulp is put into cans and frozen solid, and afterwards kept in storage at about 15° to 30° F. Sometimes the addition of glucose is made.



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Published Abstracts

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each.

Soy Flour.

Earlier methods for the manufacture of flour from soy beans generally resulted in the formation of dark-coloured products, suffering, furthermore, from the presence of a considerable proportion of matter which was insoluble in the gastric juices and so not readily digested. British Patent 397,692 of the Shellabarger Grain Products Company claims to overcome both these difficulties by a process the essential feature of which is a steaming treatment of the beans at the only moderately elevated temperature of 140° F. It is pointed out that brief steam treatment at 212° F.—which is a well-known procedure—leads to the formation of much insoluble matter. Utilising the lower temperature, on the other hand, there is not only produced a much whiter flour, but objectionable odours arising from the oily constituents of the beans are eliminated. The beans are steamed at about 140° C. for about 40 minutes, the apparatus being maintained under a vacuum of about 24 inches. An interesting feature is preliminary removal of oxygen before steaming, thus largely preventing discoloration of the flour and rancidification of the oil. Steaming is then continued until the objectionable odours and flavours, which are usually present, are eliminated. The steam inflow is interrupted and carbon dioxide gas is passed in for the purpose of cooling the mass. After processing the steamed beans in the usual manner, the expressed oil is notable for its clarity and freedom from objectionable odours and flavours, and can be used for edible purposes without any further refining treatment. It is suggested that the superior whiteness of the flour may be due either to a bleaching action of the carbon dioxide or to the fact that the formation of dark-coloured oxidation products is prevented. Reference is made to two earlier specifications: 234,402 (which claims to improve or purify soy beans by first heating them in a dry state and then subjecting the agitated product to the action of low-pressure steam for a short time) and 367,865 (a process for the prevention of oxidation of soy beans and soy bran).

Jam Setting.

Fruits with a naturally high pectin content, such as cranberries, blueberries, and tart plums, are difficult to convert into a satisfactory jelly owing to their pre-setting tendency. Thus, on cooking 50 parts cranberry juice with 50 parts sugar until the soluble solids are present in 65 per cent. concentration, pre-setting occurs to such a marked extent that the jelly is useless. It is now proposed by the California Fruit Growers' Exchange, in British Patent 397,714, to eliminate the pre-setting trouble by destroying a portion, or most, of the natural pectin by an enzyme. On inoculating the pulpy mass of fruit with pectinase and maintaining at a suitable temperature until the destructive action of the enzyme upon the natural pectin is completed, satisfactory setting properties are developed. The required amount of sugar is added to the depectinised mass, which is then jellified with the aid of a pectin possessing slow-setting characteristics. (Convention date [U.S.A.], November 10, 1931.)

Improving Coffee Bean Aroma.

Roasting does not enhance the outward attractiveness of steamed raw coffee beans, for the product is apt to exhibit uneven colouring. Apart from this, the general appearance of the batch is darkened owing to the necessity for more prolonged treatment. So-called unwashed coffee beans are also sometimes steamed with the object of improving the flavour, but with the unfortunate result that the membranes adhere obstinately to the beans and stoutly resist attempts to remove them before the roasting process. British Patent 397,729 of A. Kasper claims to overcome these disadvantages by subjecting the beans to a preliminary mild roasting treatment which is followed by steaming prior to the final roast. Whilst the preliminary roasting operation suffices to eliminate the natural water content of the beans, the intermediate steam treatment expels the harmful products arising from decomposition of pentosans, albumens, and tannic acid, which are well known to be formed during the initial stage of roasting. In the ordinary way, the latter—which include derivatives of furfural and pyridine—are largely retained in the finally roasted coffee beans with grave consequences to the flavour. Since the really fine aroma of coffee is only developed in the final stage of roasting, the present procedure of sandwiching a steaming treatment between initial and final roasting effectively removes all disturbing factors. Mention is also made of other advantages of the process in the shape of a marked improvement in keeping quality and in the absence of sweating. (Convention date [Germany], November 25, 1931.)

Caffeine-Free Coffee.

Caffeine-free coffee has been on the market for about a quarter of a century, and has generally been prepared up till now by treating the water-swollen raw coffee beans with organic solvents. Of interest as representing a fundamental divergence from this method of decaffeinisation is the process recently disclosed in British Patent 397,323 of Dr. C. Massatsch. Its main features will readily be understood from the following summary of the procedure: 6 lb. raw coffee beans are drawn with water at a temperature of 75° to 80° C. until extraction is complete. Evaporation of the extract solution is then carried out until the volume is reduced to 6 litres, at which stage the liquid contains 9 to 10 per cent. of dry extract. Caffeine is eliminated from the concentrate by passing it through a series of steam-jacketed filter tubes, which are filled with a suitable solvent such as chloroform or carbon tetrachloride maintained at the boiling point. By twice passing the liquid through the filter tubes (containing fresh solvent on each occasion), the whole of the caffeine is removed. The caffeine-free extract is then used to impregnate the washed beans which thus regain their natural aroma minus the caffeine originally present.

It is interesting to note that tea can be detheinised in the same manner, the only modification being that a little ammonia is added during evaporation of the extraction to prevent formation of resinous precipitates. (Application date, October 15, 1932.)